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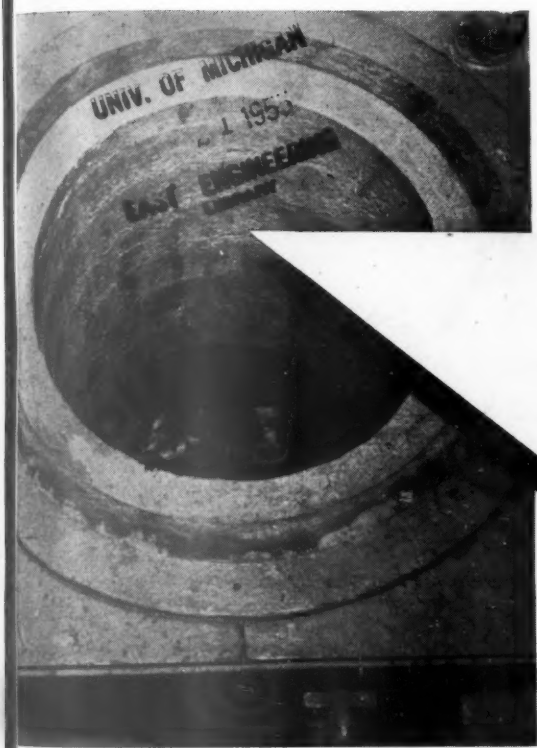

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Iron and Steel in 1958

Last week, there was laid before Parliament a report from the Iron and Steel Board on the Iron and Steel Industry, 1953 to 1958. It is an excellent account of a fine accomplishment and an intelligent appreciation of future prospects. Significant of the accomplishments was a 20 per cent. increase in steel production since 1949, whilst the total labour force went up by only 2 per cent. As to the future, the Board has taken into consideration all the pertinent factors, but rightly prefaces its estimation of demand with the phrase: "It is clearly impossible to make a precise forecast." The conclusion has been reached that a production of 22.5 million tons of steel and 15.15 million tons of pig will be the total demand in 1958. Of the pig-iron, it is envisaged that the ironfoundry industry will absorb 2.45 million tons and with this is associated 3.10 million tons of scrap. Of this latter figure, rather more than one half will arise from operations within the foundry industry.

The report is not too optimistic as to the production of iron castings in 1958. A figure of 4 million tons is estimated, but taking last year's ratio of steel production to iron castings as a basis, the output in 1958 would be of the order of 4.4 million tons. It has been noticed that in recent years the ratio has tended to fall and the authorities may have reason to envisage a further decline. The proposed creation of a new underground railway going north-west from Victoria, if put in hand prior to 1958, would materially influence ironfoundry production figures. What the effect of the railway modernization scheme will have on ironfoundry output is difficult to estimate, but in its early stages a favourable impact may be expected, though on a long-term policy the reverse will perhaps be the case.

An important factor for the foundry is that it is estimated that the cost of the development plans for the iron and steel industry is of the order of £300 million. Of this huge sum there will be substantial allocation for castings of various sorts, ranging from air bricks for the buildings, through tuyeres, ingot moulds, to rolling-mill plant. Generally speaking, wherever steel is being used, there also is to be found a corresponding quota of castings. For example, increases of structural steel for buildings; sheet for automobile bodies; plates for shipbuilding, and supplies for general engineering, all are accompanied by increased demand—in some form—for castings. The statistics for iron castings production are affected quite substantially, as to total weight, by pipe and ingot-mould production. This makes us a little more optimistic than the views expressed in the report. In this age, prophecy—no matter how intelligently based—is liable to major error, owing to national and international impacts.

Notes from the Branches

Newcastle-upon-Tyne

A meeting of the above branch of the Institute of British Foundrymen was held on February 12 in the Neville Hall, when Mr. S. Taylor of the English Steel Corporation, Limited, presented a Paper entitled "Production of Heavy Steel Castings," which was followed by a film showing stages in the production of Britain's heaviest steel casting. Mr. C. W. Stewart, branch president, was in the chair, and about 60 members and visitors were present. Immediately following the official opening of the meeting Mr. Elsdon, who represents the branch on the Institute's Technical Council, advised members that at the last meeting of the Technical Council it was decided to form a sub-committee to consider the many aspects of shell-moulding; he asked members who had first-hand experience of the subject, and would be willing to serve on such a sub-committee, to give their names to the hon. secretary, Mr. Robinson.

Introducing his subject, Mr. Taylor said that with the development of modern rolling-mill units, the large forging and extrusion presses, the demand for larger and heavier steel castings continues to grow and the foundryman is called upon to produce castings of a size and weight never before contemplated. Prior to the war, the largest steel castings made by his Company were in the region of 120 tons. Since then the foundry has been enlarged and modernized in order to make steel castings of up to 200 tons in weight. The record to date is held by press castings, which are claimed to be the largest and heaviest steel castings ever made within the British Commonwealth. He then went on to describe in detail the production of one of these castings, a 185-ton crosshead beam, with overall dimensions 26 ft. 6 in. long, 13 ft. 6 in. deep and 8 ft. 6 in. wide.

The film, which was subsequently shown, gave members a clear indication of the immensity of the job, and of the courage, skill and craftsmanship of those responsible, which combined in achieving a successful product. Several questions were afterwards raised which Mr. Taylor answered, and the meeting ended with a hearty vote of thanks to him admirably proposed by Mr. T. Burrows.

Milk in Industry

The National Milk Publicity Council of the Milk Marketing Board launched a campaign on March 1 to promote the consumption of milk among workers in industry. After a long, forced lull during the war and post-war years, the Council is renewing its campaign, started in 1936, by promoting the sale of milk in 6,000 factories in England and Wales. It hopes later to extend its programme and to stimulate even greater demand by making contact with suppliers and by a large-scale publicity programme.

The Council claims that regular daily milk consumption is of outstanding benefit to both workers and employers. It claims that statistics from the US and British firms which have had milk schemes show that absenteeism can be halved, particularly when due to colds and influenza. Milk is of special benefit to school-leavers, nightworkers, people in heavy industry, and those working in hot conditions. It is both thirst-quenching and nutritious. It builds up bodily strength and replenishes energy.

Mr. John Marsh, director of the Industrial Welfare Society, speaking for the employers, stressed that there is a need for extension of the one-third of a pint measure to industry. This amount, now confined to the school milk service, would sell more cheaply than a cup of tea, and would probably be adequate for most people, especially women. Mr. Arthur Deakin pledged full trade-union support for the plan and said that "the value of milk to the heavy worker cannot be overstressed." He thought that as an investment employers should sell milk at less than cost price.

Prices of milk to industrial consumers may vary slightly among retailers in different districts. In the publicity campaign, much more is to be seen of Miss Zoë Newton in the future all over Britain and "Chad," too, will be there to remind the public that "milk is back."

Correspondence

EXPANSION-TYPE SCABS

To the Editor of the FOUNDRY TRADE JOURNAL.

SIR,—In the course of reading the article entitled "Another Look at Expansion-type Scabs" in the issue of February 17, the following points come to mind:—

(1) It is well known that a re-entrant angle of a mould is the most likely location for a hot spot. Therefore, according to the author's theory it is here that an "exudation" scab will be formed. However, it is significant that where a re-entrant angle exists, the most common defect (in ferrous castings) is not a scab but metal penetration, because the sand in a re-entrant angle has the opportunity to undergo the alpha-to-beta quartz transformation without buckling; it is rare indeed to get a scab formation on re-entrant angles.

(2) The cope of a casting is invariably the part which exhibits the true "expansion" scab, the reason for this, as is well known, is the inability of the mass of sand to accommodate the alpha-to-beta transformation without buckling. In cases of flat copes, there is little likelihood of a hot spot occurring on the metal/mould interface. If one introduces to the sand mixture a material such as asbestos fibre, the tendency to scab will be eliminated because the asbestos fibre will accommodate the alpha-to-beta quartz transformation without buckling. Another well-known remedy is to use a sand mixture having a wide grain spread, so that the transformation does not occur instantaneously at one temperature but is spread over a range.

(3) It is extremely rare to see an "expansion" scab on a casting made in a volume-stable material, *e.g.*, olivine, zircon, chamotte, moulders' composition or the like.

According to Professor Williams, the conditions promoting "exudation" scabs are that a hot spot exists at or near the metal/mould interface and that the moulding material is porous. The writer suggests that no scabs will occur at re-entrant angles of moulds nor will they occur in moulds made of volume-stable materials. The formation of a true "expansion" scab is a function of the inability of the sand mass to accommodate the alpha-to-beta quartz transformation without buckling.—Yours, etc.,

K. STEINER.

Foundry Services, Limited,
Long Acre, Nechells,
Birmingham, 7.
February, 21, 1955.

Nodular Cast Iron*

Present Position and Future Prospects as an Engineering Material, with Special Reference to Suitability for Crankshafts

London Discussion of the Paper by S. B. Bailey, M.Sc. (Eng.), M.I.Mech.E.†

[SLIGHTLY ABRIDGED]

(*Continued from page 201*)

This section of the discussion report includes the comments of Mr. H. Morrogh (British Cast Iron Research Association); Mr. M. M. Hallett, M.Sc. (lately with the Sheepbridge Group); Mr. P. A. Russell (S. Russell & Sons, Limited); Mr. W. W. Braidwood (Mond Nickel Company, Limited); Mr. H. C. Young, M.I.Mech.E., Mr. J. E. Russell and Mr. R. J. Love, Wh.Sc. Topics include the need for a deeper understanding of ductility and brittle fracture; the variety of properties which can be produced in nodular iron; actual service results; relative cost of materials and development work; possibilities of nodular iron for rolls and other heavy castings (including a comparison with forgings), and a survey of crankshaft investigations, particularly as to the effect of design.

What is Ductility?

MR. H. MORROGH said that to indicate the relative ductility and shock resistance of nodular cast irons and other ferrous materials the Author had plotted the percentage elongation at fracture against the ultimate tensile strength in Fig. 6, and Izod impact value at room temperature against ultimate tensile strength in Fig. 13. It was important to examine the validity of those comparisons. The Author had apparently assumed that total elongation was a good measure of ductility and that the Izod impact value at room temperature was a good criterion for the relative shock resistance of widely differing materials. Before those assumptions could be dealt with, it was necessary to attempt to define the terms used.

Apparently, the Author believed that the amount of deformation at failure indicated ductility and, no doubt, there were many who would regard that as satisfactory. The limitations of the older notions of ductility had been clearly revealed by the attention devoted of recent years to catastrophic failures in welded structures. One might ask what significance deformation at failure had for the engineer who was usually interested in designing components which not only would not fail completely but which would not deform in service. A component which had deformed could in most instances be considered to have failed. In most engineering applications, resistance to deformation was a desirable property.

He suspected that the desire for high elongation values in the tensile test had developed from the very general experience that high elongation values were accompanied by good shock resistance. It was known that elongation in the tensile test was no guide to the shock resistance of a material and that materials having high elongation values might be brittle in the impact test.

Resistance to Crack Initiation

Following recent studies of brittle and ductile failure it was necessary to define terms more precisely. He believed it would be agreed by many that ductility was a measure of the resistance of a material to crack initiation, in other words, of the work required to form a crack. The resistance to the propagation of a crack, on the other hand, represented the toughness of a material.

In the ordinary tensile test the magnitude of the total elongation depended on the ductility and toughness of the material. The elongation up to crack initiation, which was approximately the uniform elongation up to the maximum load, was a rough measure of the ductility of the material. The elongation beyond the maximum load which occurred whilst the crack was being extended and the test-piece was necking was a rough measure of the toughness of the material. Ferritic nodular cast irons, which were the industrially important ductile variety, did not show significant necking in the tensile test but they frequently had elongation values at the maximum load of over 20 per cent., which was as high as, or higher than, the corresponding values for many steels. In such nodular irons the amount of elongation developed beyond the maximum load was low compared with many steels. Thus, on the basis of the definitions given earlier, ferritic nodular cast iron could be described as a ductile material but not as a tough material. Once a crack had formed in ductile nodular cast iron it was relatively easy to tear the two halves of the material apart. It could be seen from that that

* Paper presented to the Institution of Mechanical Engineers and printed in the JOURNAL, May 20, 27 and June 3, 1954. Permission from the Institution to print the discussion is gratefully acknowledged.

† The Author is on the staff of Intelligence Division, London Headquarters, Department of Scientific and Industrial Research.

the claim that Fig. 6 showed the relation between ductility and tensile strength could not be substantiated.

Once a crack had formed in a component, except in a few very special circumstances, that component could be considered to have failed and therefore it might be argued that toughness was not a property of great significance to the engineer. Similarly, ductility as measured by elongation up to the maximum load might have limited significance only and, in connection with crankshafts, at least, the Author was quite prepared to believe that plastic yielding represented failure.

Resistance to Brittle Fracture

There was, however, another aspect of ductility which was of great significance to the engineer, namely, the resistance of a material to brittle failure. That property was usually determined by some form of impact test. Ferrous materials other than austenitic might fail for a given set of conditions in a ductile manner or in a brittle manner depending on the temperature. Nodular cast irons were similar to the other ferrous materials in that respect. Ductile behaviour was represented by slip-and-shear failure and brittle behaviour by cleavage failure. Ductile failure in ferritic nodular cast irons was characterized by a dark fibrous fracture, and brittle failure by a bright crystalline fracture. The engineer was particularly concerned with the tendency of his materials to give catastrophic brittle failure. In general, those materials which showed the lowest temperature of transition from ductile to brittle failure were those materials least likely in other circumstances to fail in a brittle manner.

Ferritic nodular cast irons having 1.7 to 2.3 per cent. silicon and 0.06 to 0.08 per cent. phosphorus did not become completely brittle in the V-notched impact test until temperatures of below about −50 deg. C. Thus such nodular irons were less prone to brittle failure than many steels. By appropriately lowering the silicon and phosphorus contents, nodular irons which did not become brittle in the V-notched impact test until temperatures of below −100 deg. C. could be produced.

Gilbert (1953)* had shown that the notched impact test was largely a measure of the toughness of a material, in other words, of its resistance to crack propagation, whereas an unnotched test for nodular cast iron gave an indication of the resistance to crack initiation. It had been stated above that nodular cast irons were relatively less tough than steels. Thus, in a notched impact test, the energy to rupture of a steel in the ductile condition was relatively high whilst that of a nodular iron in the ductile condition might be relatively low. Those values, however, did not indicate the relative ability of the two materials to resist brittle failure. A material with a relatively high toughness (notched-bar impact value) would be more prone to brittle failure than a material of lower toughness but with a much lower transition temperature. It would be seen that the definitions of ductility and toughness given earlier applied whether the tensile test of impact test was used as the criterion.

It had already been argued that toughness was of limited significance in the design of most engineering components and that, therefore, the relative positions of the various curves in Fig. 13 had a corresponding lack of meaning. In fact, they were definitely misleading since they did not give any indication of tendency to brittle failure, which might be relatively different.

That brought one to a consideration of the use and interpretation of the results of notched-bar impact tests. It was becoming increasingly widely recognized that that test, when carried out at room temperature, could only sort materials likely to behave in a brittle manner from those likely to behave in a ductile manner at room temperature. Each material gave a characteristic value for brittle failure and a characteristic value for ductile failure. It was permissible to plot impact values of one material which had been subject to various treatments, but it was not permissible to plot impact values of various materials, even if the materials were all steels, without reference to their respective transition curves. The resulting plot had no engineering significance. The author had repeated an error which showed considerable disregard for the work of the last ten years on the subject of ductile and brittle failure.

The low transition temperatures of nodular cast irons might be surprising to many because it would not be widely recognized that while nodular graphite particles reduced the toughness of the material they also served to lower the transition temperature. Nodular cast irons had very low oxygen and sulphur contents, which was also an advantage in that connection.

Properties to Specification

The Author completely failed to recognize the inherent ductility of ferritic nodular irons of appropriate composition. Some nodular irons would behave as brittle materials but the influence of composition on the impact transition temperature was well understood and manufacturers limited the composition and treatment of the material in such a manner that brittle failure was very unlikely when ductility was specified. It was nevertheless true that the high-strength pearlitic nodular cast irons had low ductility and that only annealed ferritic or quenched and tempered nodular irons could be considered as truly ductile materials. That did not, however, justify the Author in this statement that "under impact conditions nodular cast irons are somewhat better than flake graphite irons." The ferritic nodular cast irons were very different from flake graphite irons: the former could be ductile but the latter were always brittle.

It was surprising that the Author had chosen to overlook the extensive treatment of that aspect of the ductility of nodular cast irons which had

* Gilbert, G. N. J. 1953. British Cast Iron Research Association. *Jl. of Research and Development*, 4, 458.

already appeared from several sources in the literature.

In the synopsis to the Paper it had been stated that nodular irons in the as-cast condition might be used instead of high-grade flake-graphite irons for components not subject to shock loading. That might be interpreted to indicate that as-cast nodular irons were inferior to high-grade flake-graphite irons for such components. Thas was not correct.

The Author had dismissed nodular irons containing copper with the statement that they had inferior properties to those produced with nickel/magnesium alloys. That statement needed amplification to avoid being misleading. The effect of copper in nodular irons was complex. Its presence greatly exaggerated the effect of subversive elements such as titanium and lead, and could prevent the development of a nodular-graphite structure in an iron treated with magnesium alone. However, if a small addition of cerium was made that harmful effect of copper could be neutralized. Magnesium could be added to cast iron in the form of a copper/magnesium alloy but, when alloys having 15 to 20 per cent. of magnesium (comparable with the nickel/magnesium alloys in common use) were used, the yield of magnesium was relatively low compared with that from nickel/magnesium alloys. However, if copper/magnesium alloys having 25 to 35 per cent. magnesium were used, even though the actual yield of magnesium was low, the amount of addition required was roughly the same as that required when a nickel/magnesium alloy having 15 to 20 per cent. magnesium was used. That could provide a cheap addition, particularly if it was prepared from copper and magnesium scrap, but some cerium had to be used, either combined with the alloy or added after it.

Copper was a pearlite-promoting element. Its presence in nodular cast iron of good graphite structure tended to encourage high tensile strengths and low elongation values. There were many applications where high tensile strength was required and for those the copper-containing nodular irons appeared to be satisfactory. Nodular irons containing copper could not be annealed to the ferritic condition so easily as otherwise similar irons free from copper.

Yield or Proof Stress

It was notable that no reference had been made in the Paper to yield-stress or proof-stress values for nodular cast iron. It was his own experience that those data were usually requested by engineers. Strictly speaking, nodular cast irons did not show a yield point in the ordinary tensile test, that was to say, there was no point where the elongation increased rapidly without increase of load. There appeared to be a smooth transition from the region of the stress-strain curve which was largely elastic to that portion showing plastic yielding. For such materials the proof stress had to be specified. A few typical proof-stress figures for nodular irons were given in Table V.

TABLE V.—*Typical Proof-stress Figures for Nodular Irons.*

	Ultimate tensile stress, tons per sq. in.	0.05 per cent. proof stress, tons per sq. in.	Elongation,* per cent.	Brinell hardness number.
As-cast pearlitic ..	48.0	23.7	3	257
Heat-treated ferritic	26.9	16.2	28	138
Normalized, pearlitic	51.5	30.7	3	271
Quenched 900 deg. C., tempered 4 hours at 600 deg. C. ..	53.7	37.2	5	278
Quenched 900 deg. C., tempered 2 hours at 600 deg. C. ..	60.9	41.5	4	298
Quenched 900 deg. C., tempered 1 hour at 600 deg. C. ..	62.2	43.2	3	331

* Measured on $4\sqrt{A}$.

The remarkable increase in proof stress obtainable by quench-tempering (and indeed by normalizing) was noteworthy. Some fatigue data were available on the fifth iron in Table V, tempered for 2 hr. at 600 deg C. and those were given in Table VI.

TABLE VI.—*Fatigue Data.*

Reversed-bending fatigue-strength (plain), tons per sq. in..	22.0
Reversed-bending fatigue-strength (notched), tons per sq. in.	13.5
Endurance ratio	0.36
Fatigue-strength reduction factor	1.63

Although quenched-tempered nodular irons had been used for crankshafts the evidence given above suggested that the increased proof stress was not accompanied by a corresponding increase in notched fatigue strength, although further work would have to be carried out.

Actual Production Records

Mr. M. M. HALLETT, M.Sc., said that, as would already have been appreciated from the remarks of Dr. Angus and Dr. Everest, foundrymen looked rather askance at some of the inferences drawn by the Author. The paragraph to which foundrymen objected particularly was the one in which he had referred to continued failures and the loss of confidence by engineering firms and research organizations. He did not want to labour that point, but by way of reassurance he would make three simple, unequivocal statements.

On checking through the production records of his own company over the previous five years—which amounted to several hundred heats—he had found only three or four heats which did not show an entirely satisfactory spheroidal-graphite structure. For each of those three or four heats there was a perfectly simple, rational, and straightforward explanation. He would add that those heats were all made when using an addition of nickel/magnesium alloy to an approved pig-iron. The Author's statements amounted to little more than saying that if anyone experimented with unknown sorts of pig-iron, and did not follow the results laid down by those who were competent to give information, he could expect to run into trouble.

Secondly, during the same period he could recollect no case of a casting having been returned by a customer as showing unsatisfactory spheroidal graphite.

Nodular Cast Iron—Discussion

Success in Service

Thirdly, in regard to the crankshaft illustrated in Fig 22, approximately 20,000 of those crankshafts had been made and delivered. To date there had not been one single instance of failure in service.

Having made those general points, he had one or two brief technical points to make. The Author had devoted most of the Paper to a description of spheroidal-graphite iron in the as-cast and the annealed conditions. It could also be heat-treated in a number of other ways, by oil-quenching and tempering, in exactly the same way as an alloy steel. In fact, those crankshafts were all heat-treated, not to give ductility but to give another desirable combination of properties. Tables VII and VIII illustrated that point.

TABLE VII.—*Percentage Composition of S.-g. Iron.*

Total carbon.	Silicon.	Manganese.	Phosphorus.	Nickel.	Magnesium.
3.3	2.6	0.37	0.06	2.5	0.07

TABLE VIII.—*Mechanical Properties of 1-in Keel Blocks in S.-g. Iron.*

Condition.	Maximum stress, tons per sq. in.	Elongation, per cent.	Vickers pyramid hardness number.	Impact value (0.45 in. unnotched).
As-cast	42	1–2	300	7
Air cooled at 900 deg. C.	50	2	310	15–20
Oil-quenched, tempered at 600 deg. C.	50	4	270	20–30

All those crankshafts had been heat-treated because in that condition they gave the best combination of wear resistance on the journals and freedom from failure, as exemplified by the results.

The Author had referred in his remarks on the annealing treatment to the material usually being annealed for 4 hr. at 900 deg. C. That was an extraordinary treatment which would certainly not necessarily produce a ferritic background. The ferritic background would be formed at much lower temperatures. If the material were cooled slowly from 900 deg. C. then ferrite would be formed, but normally it was treated at a much lower temperature.

Mr. P. A. RUSSELL, B.Sc., said that the Author had stated in regard to s.-g. irons that the " impact resistance is very poor compared with that of the cast steels, and engineers will regard with some suspicion their employment for components which have to withstand sudden shock loads."

He would provide illustrations of an example of s.-g. iron castings employed under very severe shock conditions, where the designers had specially selected that material as being superior to any other material available as castings, except some of the more expensive alloy steels. [Here, Mr. Russell produced an illustration of a test rig and cited details.]

The engineer concerned reported that " examination of the castings after considerable use has found that there are no signs of failure, and they are performing satisfactorily." That was one of the many uses to which s.-g. iron was being put in replacement of steel castings or forgings. Finally, as a manufacturer he wished to confirm Mr. Hallett's experience of the very great reliability that could be obtained by using the nickel/magnesium process.

Costs

Mr. W. W. BRAIDWOOD said that the Paper placed undue emphasis on the need for " low-phosphorus ore " in manufacture of s.-g. iron. The Author had ignored the fact that, although, as with malleable cast iron, hematite pig-iron might form part of the charge, the base metal of primary importance was steel scrap which was available in Britain at low cost. A few examples might make the position clear.

When the acid-lined cupola was used and hematite iron was employed, the typical sharge would be:—

	Per cent.	
(1) S.-g. iron returns ..	40	
Hematite pig-iron ..	40	
Steel scrap	20	

The new, *i.e.*, non-circulating base metals, would therefore comprise one part of steel with two parts of hematite pig-iron.

In Britain, however, use was being made mostly of refined iron prepared by pre-melting of hematite iron with steel scrap, generally in about equal proportions. When such material was used in the acid cupola the typical charge was:—

	Per cent.	
(2) S.-g. iron returns ..	40	
Refined iron ..	50	(equivalent to 25 per cent. hematite and 25 per cent. steel)
Steel scrap	10	

and the new metals would represent one part of steel with 0.7 of hematite pig-iron.

The latest type of refined iron made for that purpose was prepared in the basic cupola from greater proportions of steel scrap, understood to be 70 per cent. or more. Morever, the resultant iron was of especially high carbon content and could be remelted in asociation with greater proportions of steel scrap. A typical charge was:—

	Per cent.	
(3) S.-g. iron returns ..	40	
Basic refined iron ..	40	(equivalent to 28 per cent. steel and 12 per cent. hematite)
Steel scrap	20	

The new metals, therefore, comprised one part of steel with one-quarter part of hematite pig-iron.

Where the basic cupola was used in the producing foundry all of these proportions of steel scrap were increased. Indeed, in the United States, where the basic-lined cupola was in wide use, it was not unusual to charge no pig-iron whatever and melt:—

	Per cent.
(4) Returned s.-g. iron returns ..	40
Steel scrap	60

When electric furnaces were used, the most economical charge and one which gave perfect response to magnesium treatment was that composed essentially of steel scrap and carburizer only (5).

On the basis of hematite pig-iron at £18 per ton, special refined iron at £22 per ton, and steel scrap at £8 per ton, the cost of new metals used for those various charges was:—

(1) £14 13s. 4d.
(2) £19 13s. 4d.
(3) £17 6s. 8d.
(4) £8 0s. 0d.
(5) £8 0s. 0d.

The economies associated with use of the basic cupola and the electric furnace would be evident from those figures.

Development Expenses

In considering costs, the Author had stated that ". . . as much as £200 per ton . . ." was being asked for ". . . nodular iron castings for the motor and agricultural equipment industries in 1952. . . ." It had to be borne in mind that many of the s.-g. iron castings made earlier, and some still called for, fell into the category of "one off" or "small numbers off," and, in addition, that such castings were often of particularly exacting type which had been problems of long standing to the steel, malleable-iron, or non-ferrous-metal founders who had previously produced them. In such cases, a quotation of as much as £200 per ton needed to cause no surprise but it would be quite erroneous to regard such a figure as normal.

Moreover, when comparisons were attempted, it must never be overlooked that, whereas the prices for castings in steel and malleable cast iron were for the products of foundries developed over generations or specially built to suit those manufacturing processes, there was, at that still early stage of development, no foundry in Britain laid out especially to produce s.-g. iron. Fair comparison of eventual economies would be possible only when such specialist foundries existed.

As the Author himself had indicated, various methods for treatment with metallic magnesium were currently being energetically pursued. Indeed, his list was by no means complete. Some of those were showing good prospects of effecting a really substantial decrease in treatment costs, and it was virtually certain that the succeeding few years would show a complete change in the cost position, placing the conventional materials at marked disadvantage.

The Author had mentioned the excellent results from use of Swedish iron. It was nevertheless the case that the producers of s.-g. iron in Scandinavia included makers of charcoal iron who used, for magnesium treatment, with fully satisfactory results, synthetic iron prepared in electric furnaces.

The Author had stated that there had been little experience with basic cupolas in Britain, except at Dagenham. It was indeed true that one company had done most of the pioneering work but two British licensees of his own company were currently using basic-lined cupolas for routine production of s.-g. iron and, as already mentioned, refined iron was now being melted in Britain in similar units on a considerable and increasing scale.

Deserved Failures

The Author had stated that "Founders have tried to produce nodular cast iron using indigenous ores and scrap iron contaminated with various residual elements and have produced castings showing little evidence of nodular structure." His only comment was that, if such ill-suited base material were used, failure might be not only expected but even thoroughly deserved.

As was well known, the announcements of the cerium and magnesium processes had led many people to dabble in experiments without detailed guidance of any sort and without reading the relevant patent specifications when they had become available. The responsibility for failures in circumstances such as those, and as outlined by the Author, could not be laid at the doors of the originators of the processes.

Naturally, there had been failures in licensed foundries also, and it might be asked whether any new procedure or indeed any established one was free from risk of occasional failure. It did not need to be emphasized that any failure which might be experienced in operation of a new process was liable to be much publicized. The fact was, however, that production of s.-g. iron was continually and rapidly increasing and improving in all respects. At present s.-g. iron castings were covered by private specifications agreed between user and producer but preparation of a British standard specification was impending.

It was true that, in the magnesium process, development of the technique which involved supplementary addition of a very small proportion of mischmetall, to overcome the adverse effects of certain incidental elements, had been of help. The expanded production of fully suitable, base irons, the use of greater proportions of steel scrap and of more suitable melting units, and so forth, were, however, steadily rendering dependence on supplemental addition of mischmetall less necessary. Incidentally, the figures given for cost of mischmetall might be much reduced because an addition of 0.01 per cent. (4 oz. per ton and not 8 and even 13 oz. as stated), when effectively introduced subsequent to magnesium treatment, was sufficient in all normal cases.

The Author had made rather scornful reference to probable production rates of s.-g. iron in Britain. It was as well to remember that, in Europe, commercial production had not begun until early in 1950 and was, therefore, only entering its fifth year: that was a short time in any new development of that scale. It ought also to be borne in mind that

the total capacity of the iron foundries of Western Europe, so far as it could be determined, was only 12-13 million tons, compared with about 16 million tons in the United States. Despite those considerations, the total production for 1953, of finished s.-g. iron castings by licensees in Europe, was more than 80 per cent. of the corresponding total for their American counterparts.

Great Future in Store

MR. H. C. YOUNG, M.I.Mech.E., A.M.I.E.E., said that he had seen that iron at the Sheffield Summer Meeting of the Institution in 1953 when he had visited a foundry there. He had seen the tests and some of the applications, and it had made him most anxious to see that material developed. In his opinion there was a great future for the iron; he was speaking as one who hoped to use it.

In the rubber and plastics industries, with rolls for mills and calenders, one was faced with very difficult problems of temperature control, largely owing to the great thicknesses of the roll and calender ends—so much so that the designers in the United States and Germany had taken the gears away from the cheek of the calenders and had placed them in separate housings, so that the mass of metal was not on the ends of the rolls dissipating the heat.

On a calender roll the thickness at the ends was 10 in., and at the centre 6 in. There were other roll machines of very similar dimensions. Those rolls went up to 36 in. dia., and they were about 90 in. long on the face. They rolled out material 0.003 to 0.004 in. thick. Inside there was either steam, warm water, or cold water, and the heat affected the bearings. It was necessary to oil-cool the bearings, so that there was a conflict between the cooling of the bearings and the heating of those rolls. He wished to ask the Author how near was the day when that iron could be used in rolls of that nature, which weighed up to 10 or 15 tons.

There was another aspect in which that particular iron might help. In the 1939-45 war certain tank wheels had been made of cast iron, and the micro-porosity on the surface of the cast iron had made it most difficult to brass-plate them for bonding tyres to the iron. What happened in that case was that there were little passages, into which the cleaning liquor penetrated prior to the carrying out of the brass-plating and putting on of the rubber tread. During cure at a temperature of about 360 deg. F. expansion of the cleaning materials resulted, destroying the brass-plating, and so produced a tread failure. He wished to ask the Author whether he had any information on the micro-porosity at the surface of the iron.

Other Applications

The Paper had stated no maximum size of casting. He had seen some fairly heavy rolls being produced at one foundry. The Brinell hardness was an interesting problem to men who were interested as he was in the matter. It was necessary to chill rolls to a depth of about ¼ in. or even more, and a Brinell hardness around 500 Brinell resulted. About 1921 he had persuaded a manufacturer to produce mixing mills in steel roll—the mixing-mill roll had been 4¼ in. thick—of 1¼ in. The cooling effects had been so great that certain mixes which it had not been possible to make on cast-iron roll were easily produced on steel rolls. He understood that they had been discarded because of fatigue failure, but they must have earned their cost many times over.

A further problem that he was faced with in using cast iron concerned hydraulic cylinders for platen presses for plastics and rubber which had up to recent years been made of cast iron. As pressures per square inch increased, cylinders failed, the failure being where the iron changed direction. Cylinder after cylinder had had the ends pushed off, so that one would almost think they had been machined off. The end of the cylinder came clean away and it had been necessary to use steel. He wondered how the nodular cast iron would stand up to that use.

The plastics and rubber industries were quite large users of iron for the manufacture of the moulds. He remembered the time when all the moulds had been in cast iron, but the breakages had been so great that recourse had been made to "semi-steel"—and the breakages had been just as great. Finally, the change had been made to steel, so that currently most moulds were made of steel. There were certain difficulties in machining steel, and he wondered whether it might be possible to do with nodular cast iron what was being done with aluminium.

Comparison with Forgings

MR. J. E. RUSSELL said that, despite what had been said by earlier contributors to the discussion, he personally, as a steel metallurgist, had found the Paper extremely interesting, and he considered that the Author appeared to have treated his subject, so far as crankshafts were concerned, with considerable impartiality.

Obviously, cast crankshafts had to stand or fall by comparison with wrought crankshafts, which had held the field in engineering for so long. He proposed, therefore, to pass a few remarks on the effect of the degree of forging on crankshaft material in relation to the fatigue properties.

The Author had collected considerable comparative fatigue information, which he had cited in Appendices. However, Fig. C showed some results on bars given different degrees of forging reduction, reported by Krainer (1942).* Three steels had been investigated—a chromium/molybdenum/vanadium steel, a manganese/chromium/molybdenum steel, and a 3 per cent. nickel steel. The degree of reduction from the ingot varied over the range of 3/1 to 45/1. Considerable care had been taken to machine the specimens in such a way as to maintain more or less comparable metallurgical structures in all bar sizes which had all been hardened

* Krainer, H., 1942, *Archiv für das Eisenhüttenwesen*, 15, p

and tempered up to the tensile strength shown (Fig. C). The fatigue tests had all been taken in rotary

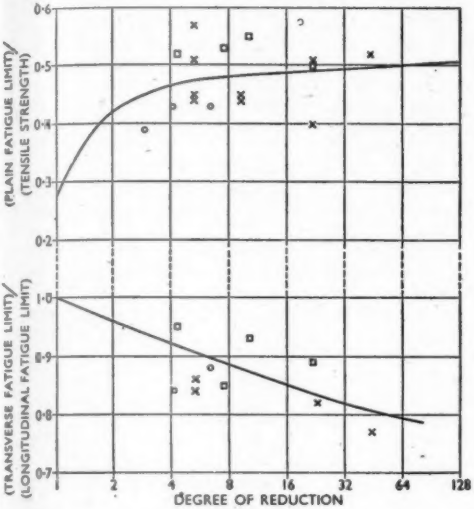


FIG. C.—*Results on bars given different degrees of forging reduction.*

Key.—× 1 per cent. nickel steel, about 35 tons per sq. in. ultimate tensile strength; Manganese-chromium-molybdenum-vanadium steel, about 79 tons per sq. in. ultimate tensile strength; and □ 3 per cent. nickel-chromium-molybdenum steel, 50 tons per sq. in. ultimate tensile strength.

bending, in both longitudinal and transverse directions on both smooth-polished and notched test-pieces. The upper curve showed the fatigue ratio, in other words, the longitudinal fatigue limits for the smooth specimen divided by the tensile strength, plotted against the degree of reduction. For zero reduction, *i.e.*, the cast structure, he had taken a fatigue ratio of about 0.28, which was the mean ratio generally found for cast alloy steels, and was in agreement with the figures given in Appendix II. For very large degrees of reduction the fatigue ratio tended to be about 0.5 to 0.58. It would be seen that the curve rose at first fairly rapidly with the degree of reduction, but that after about 4/1 there was little further advantage gained. In actual fact, of course, in practice it was convenient to maintain higher degrees of reduction in order to use a reasonably convenient ingot size, and the reduction on an average motor-car crankshaft was of the order of 60/1.

On the other hand, it had to be admitted that the transverse fatigue properties tended to fall off at the higher degrees of reduction. That was shown in the lower curve in Fig. C, where the ratio of the transverse to longitudinal fatigue limits was plotted against the degree of reduction. That ratio would nominally be 1.0 for a cast structure, but tended to fall off towards a value of about 0.75 with increasing reduction. For the particular notch size used by Krainer, the reduction in the fatigue limits by notching was practically constant over the range of reductions investigated, but unfortunately it was not possible to say what that reduction would have been for a cast structure.

Fatigue Ratios

In regard to certain specific points in the Paper, he considered that there was one conclusion not very complimentary to nodular iron which might be drawn from the fatigue tests on cast and wrought materials which the author had conveniently summarized in Appendix II, and which covered all the really relevant sources of information on that subject.

In the first place, the fatigue ratios for the plain specimen of wrought steel were of a much higher order than those of the cast steel or iron—much more, indeed, than would be expected from the notched results, which the Author had used in Fig. 12. The mean ratio of the wrought steel was 0.597; that of all the cast materials was 0.418. For the heat-treated nodular iron alone, which was the best of the cast materials in that respect, the mean ratio was 0.454.

On the other hand, the wrought steel tended to have a rather high notch-sensitivity, leading to relatively high "strength-reduction ratios" for a particular notch, although unfortunately the notch dimensions on the wrought and cast material of Appendix II were different. However, the wrought alloy steel could be treated to considerably higher tensile strengths than the cast ones, which more than compensated for that strength-reduction factor. The flake-graphite grey iron was much softer and its fatigue ratio was so low that it could not achieve the notched strength of wrought steel despite its low notch-sensitivity. The nodular iron, however, came in for the worst of both worlds, for, although somewhat harder than the grey iron, it could not reach the tensile level of alloy steel, and also the removal of the flaky type of graphite had brought up the strength-reduction factor to almost the same level as the wrought steel, so that, on balance, it was no better than the grey iron.

He wondered whether it might not have been better to concentrate on trying to harden the flake-graphite type of iron, rather than "nodularizing" the graphite, at least for applications such as crankshafts: he excepted, of course, all the many other applications for which nodular iron had been so useful. The ductility would still be low, but, as the Author had pointed out, that might be of negligible significance, and he fully agreed. In spite of Mr. Morrogh's careful distinction between toughness and ductility, neither had any relation to processes of fatigue failure.

Automobile Crankshafts

MR. R. J. LOVE, Wh.Sc., A.M.I.Mech.E., said that he found the comparisons of mechanical properties of the various materials, as given in the Paper, to be of great interest, and in view of the importance of fatigue strength he would like to have seen a graphical representation of unnotched fatigue

Nodular Cast Iron—Discussion

strength plotted against tensile strength. He realized that the information was given in tabular form in Appendix II, but a graph after the fashion of that given for notched fatigue strength, as in Fig. 12, would be more informative.

At the same time, he ought to point out that from crankshaft experiments at the Motor Industry Research Association it had been concluded that simple notched or unnotched fatigue specimens did not necessarily give an indication of the relative merits of cast materials, and that, to obtain a reasonable comparison of materials, tests on full-size crankshafts were necessary.

The Author had stated the need for a comparison of fatigue strengths of forged and cast crankshafts of the same design. At the Motor Industry Research Association there had, in fact, been the opportunity on two occasions to make such a direct comparison, using production crankshafts of automobile size. In the two investigations, using a flake-graphite iron of about 26 tons per sq. in. tensile strength and a steel of 55 to 65 tons per sq. in. tensile strength, the high-duty flake-graphite-iron crankshafts had about half the bending fatigue strengths of the forged crankshafts.

Design Factors

That would appear to place the cast crankshaft in an unfavourable light, but, in his opinion, much could be done to improve the strength of the cast crankshaft in relation to that of the conventional forged one. Increase of fillet size was the most important single design change to improve fatigue strength. In addition, tests had shown that a simple cold-working process was very beneficial. In tests on a high-duty flake-graphite iron, rolling the crankshaft fillets had given an increase of bending fatigue strength of no less than 60 per cent., and recent tests on graphitic cast steel and forged-steel crankshafts suggested a similar improvement. To date little was known about the production requirements of that process, but a process giving such a good improvement of strength clearly demanded some consideration. With care in design and production, with some increase of fillet size, and allowing for the stated improvements due to rolling, it would readily be possible to produce cast crankshafts with as high a bending fatigue strength as that of many existing forged crankshafts.

Furthermore, he would make the point that to say that a cast shaft was weaker than a forged shaft in laboratory tests was not to say that the cast shaft was necessarily inadequate for service operation.

The use of cast shafts in a wide range of engines was well established. In view of the excellent results which had been obtained with flake-graphite iron in many engines—and that included its use in automobile engines—there was no doubt that in respect of strength the nodular-iron crankshaft with its somewhat greater bending fatigue strength and greater torsional stiffness would be at least equally successful.

Two important aspects of the use of the nodular iron appeared to remain; one concerned the wear properties and the other concerned cost and availability. The Author had discussed the question of surface finish and hardness, but he would pose the question whether service experience with nodular-iron crankshafts did, in fact, show the very good wear properties which were found, for example, with flake-graphite iron. The second matter, which concerned future prospects in cost and availability had been dealt with excellently in the paper.

European Research Fellowships

The Council of Europe and the High Authority of the European Coal and Steel Community will award jointly a number of fellowships in 1955 for research into problems of European interest. Each fellowship will carry a stipend of 300 000 French francs.

Candidates for the Council of Europe fellowships are invited to submit subjects for research in connection with: European economic integration; European political integration; or European history and philosophy in relation to contemporary problems.

Candidates for the High Authority fellowships are invited to submit subjects for research into economic, legal, and social problems relating to the European Coal and Steel Community and its institutions.

All candidates must normally be nationals of a member State of the Council of Europe, but an exception will be made in favour of refugees from European countries which are not member States of the council provided that they are legally resident in the territory of a member State. Further particulars and forms of application, to be returned before March 15, may be obtained from the Controller, Education Division, British Council, 65, Davies Street, London, W.1.

Iron-ore Imports

The appended table shows the tonnage and value of iron-ore imports in January, 1955, and gives comparative figures for the corresponding month in 1954.

Country of origin.	Month ended January 31.		Month ended January 31.	
	1954.	1955.	1954.	1955.
	Tons.	Tons.	£	£
Sierra Leone	68,750	32,550	392,235	178,945
Canada	95,138	52,341	373,353	205,654
Other Commonwealth countries and Eire..	1,062	1,919	2,934	5,492
Sweden	308,409	313,097	1,658,576	1,719,642
France	43,477	40,274	166,653	147,067
Spain	24,250	37,245	131,455	189,514
Algeria	164,952	160,114	863,974	864,788
Tunisia	32,230	68,587	166,682	343,415
French Morocco ..	15,832	26,720	75,400	109,059
French West Africa ..	57,204	28,164	242,449	119,321
Spanish Morocco ..	18,125	5,400	136,070	40,702
Liberia	9,450	19,420	76,860	115,539
Brazil	18,755	18,005	156,205	130,160
Other foreign countries	20,389	11,985	118,486	67,548
TOTAL	878,023	815,821	4,561,332	4,236,844

Argentine Steel Production

A company formed with mixed State and private capital to erect a steelworks at San Nicolas, the Sociedad Mixta Argentina, has increased its capital from 500,000,000 pesos to 3,000,000,000. The State will contribute 2,400,000,000 pesos, the balance being left to private investors. Work on the site and buildings has been proceeding for the last two years and the project has now reached the point where equipment must be purchased. An agreement has been reached in principle with the American McKee interests for the installation of the blast furnace, to cost US$ 15,000,000. The contract for the coking plant, costing US$ 5.000,000, went to a German firm.

The purpose of the San Nicolas plant is to raise steel production under the Second Five-Year Plan to 1,040.000 tons of raw steel by 1957, an increase of 485 per cent. over 1951. The new works will contribute 500,000 tons, private enterprise a similar quantity, and military establishments 40,000 tons.

In September, 1954, Dalmine SAFTA inaugurated a factory at Campana, in the province of Buenos Aires, to make seamless tubes. Initial output will be 50,000 tons annually. The paid-up capital of 120,000,000 pesos includes foreign capital already established in Argentina and, therefore, not affected by the Foreign Investments Law. Permits were obtained to import machinery to the value of US$ 8,000.000 and the Industrial Bank granted a loan of 70.000.000 pesos. Argentina requires approximately 100,000 tons of seamless tubes annually.

British Trade with Belgium

British firms will have a chance to show Belgium what they can do at the Brussels Exhibition, which will be held from April 15 to October 15, 1958. While definite booking of space will not be asked for until late 1956 or early 1957, British firms who are interested in the exhibition are asked to let the Board of Trade know by April 30 of this year, but such a notification will not commit them to taking part.

The Official UK exhibit is intended to be broadly representative of this country's achievements within the main theme of the exhibition (man in relationship to his material environment), but it is unlikely to take a form which will easily incorporate displays by individual firms. Accordingly, the Government intends, provided industry indicates the necessary support, to erect a special pavilion in which space will be let at cost price to UK firms who are anxious to exhibit. A rough preliminary estimate of the cost of space, including a shell stand, is £3 per sq. ft. at current prices. The size of this industrial pavilion will depend on the number of firms wishing to take part and on the size of their stands, which, in turn, will affect the total size of the UK area. The Government has to decide and submit this bid to the Belgian authorities by June 30.

Interested firms are accordingly asked to get in touch as soon as possible with the exhibition branch of the Board of Trade, Lacon House, Theobalds Road, London, W.C.2.

To encourage and facilitate research in the application of light alloys to ship construction, a research scholarship worth £400 per annum and tenable for two years has been offered by the Aluminium Development Association. The scholarship will be administered by a committee of the Institution of Naval Architects and it is hoped to make an award in September. Full particulars of entry, which closes on June 30, can be obtained from the secretary of the Institution at 10, Upper Belgrave Street, London, S.W.1.

Basic Materials Prices Rise in January

A rise of 2 per cent.—the biggest monthly increase for over three years—was recorded in the overall level of prices of basic materials used in industry in January. The level of the index prepared by the Board of Trade (June 30, 1949 = 100), at 149.3, was 6 per cent. higher than in January, 1954.

The main causes of last month's overall advance were rises in the prices of raw rubber (15.2 per cent.) and copper (8 per cent.). Prices of other raw materials, however, also contributed, including aluminium (up 4.5 per cent.), zinc (up 3.7 per cent.), tungsten ore (up 8.4 per cent.), and home-produced heavy steel scrap (up 2.9 per cent.). These rises were only slightly offset by a decline over the month in the price of tin ingots by 1.8 per cent.

The most substantial increases were for materials used in the mechanical engineering and the electrical machinery industries, the indices for which rose respectively by 2.1 per cent., or 3.2 points, to 159.0 and 3 per cent., or 5.1 points, to 173.4. This marked rise, in both cases, was mainly due to higher prices for various non-ferrous metal semi-manufactures—particularly brass ingots, which rose in price by 6 per cent.

Further "50-50" Rule Attack

A further attack has been made by British shipowners on the "50-50 rule," under which at least half of 250,000 tons of American-aid coal must be shipped to this country in United States vessels. The annual report of the United Kingdom Chamber of Shipping describes the agreement as a most disturbing manifestation of flag discrimination. "Quite apart from the precedent this sets for less highly developed countries," the report says, "it substantially broadens the application of the system of cargo preferences which hitherto were at least theoretically confined to American-aid cargo.

"When the United States initiated vast aid schemes in the immediate post-war years, shipowners of the recipient countries, appreciative of the generosity of their great ally, felt constrained to accept the *ad hoc* application of the 50 per cent. principle to the cargoes moving under these schemes. It was their declared hope, however, that this was but a passing phase, and that with the gradual return to more normal conditions this artificial restraint on the provision of international shipping services would be removed. It was, therefore, a great disappointment when the Cargo Preference Act became law with the apparent object of perpetuating this objectionable discriminatory policy."

Winding up of Bridgend Foundries

On the petition of the Wales Gas Board, Mr. Justice Vaisey, in the Chancery Division on February 21, made an order for the compulsory winding up of Bridgend Foundries, Limited.

Mr. L. H. L. Cohen, for the petitioners, said the matter had been standing over 14 days for the company to formulate proposals for the payment of its debts. The Wales Gas Board were judgment creditors for £485 for gas supplied and work done. The position was that another creditor had levied execution on the assets of the company. He had sold substantial assets and the sheriff was holding the proceeds of sales.

The proposals formulated were not acceptable to the petitioners and they pressed for a compulsory order.

"No Cause for Pessimism" at Falkirk

"In general, there is no cause for pessimism about the future of the industry." This reassuring statement is contained in a letter received by Mr. Macdonald MacPherson, Member of Parliament for Stirling & Falkirk Burghs, and written by Mr. Harold Watkinson, M.P., Parliamentary Secretary to the Ministry of Labour, in which the writer outlines the findings of an inquiry conducted by the Ministry's Controller in Scotland into the position of the light-castings industry in the Falkirk-Bonnybridge area.

Mr. Watkinson writes: "You are, of course, familiar with the basic facts of the situation. From the end of the war until the spring of 1952 the light-castings industry showed every sign of prosperity. It increased its labour force and there was a shortage of skilled workers; redundancies were rare, and short-time working negligible. Then came the setback which caused a slight recession in industry generally and affected the Falkirk light castings industry, particularly that section of it manufacturing cookers, stoves, and grates. Several firms attributed their initial difficulties to the imposition of import restrictions by Australia, but it appears that these were not the main cause of the recession in Falkirk which seems to have been due to two main factors:—

"(1) The post-war accumulation of orders had been overtaken, and this was combined with a reluctance by merchants to hold large stocks; (2) the continued decline in the use of cast iron in housing fitments, and its replacement by alternative materials. It has, for example, been estimated that the average post-war house contains little more than half the weight of cast-iron products compared with a similar house before the war.

"As a result of the recession in the industry, short-time working existed, and increased in intensity in 1953, until by the summer as many as 1,600 workers were affected at a time. Parallel with this, there was a loss over the year of some 700 workers from the industry. Towards the end of 1953, under-employment rose, but in 1954 there was a further (but less pronounced) fall off in demand, leading to renewed short-time working affecting about 1,200 workers at a time, and a further loss of about 300 workers to the industry.

"By August, 1954, however, under-employment had practically disappeared, and the industry's labour force had begun to expand again. It seems that a seasonal pattern of employment has developed, particularly in the section of the industry manufacturing cookers, stoves, and grates, leading to a marked slackness in the spring and summer as a result of the falling off in demand. For example, at the December count only 510 males and 667 females were unemployed at Falkirk, Grangemouth and Bonnybridge, compared with 1,511 males and 931 females in April, 1953, and the unemployment rate had fallen from 5.1 to 2.5 per cent.

"The broad effects of these changes were an increase of about 300-350 in the numbers registered as wholly unemployed and the loss of about 1,000 (or 10 per cent.) of its labour force. The impact of these developments was not, however, as severe socially as it perhaps appeared at first sight. The increased unemployment was largely amongst women (a high population of whom were married), and practically all the male workers who left the industry were quickly re-absorbed elsewhere. The financial loss to unemployed workers was generally only one shift per week which was partly made up by the receipt of two days' unemployment benefit. Piece-rate work continued and from time to time certain sections of the industry worked substantial overtime.

"While I cannot, of course, give an authoritative forecast of future developments in the industry, the result of the inquiry leads me to hope that in the absence of violent—and at present unforeseen—market fluctuations, the present level of employment should remain substantially unchanged. The normal seasonal influences may, however, be expected to continue and some under-employment may be unavoidable for a short time each year. There is little that the Government can do to correct this as Government contracts account for only five per cent. of the light castings produced in the Falkirk district.

"As I said earlier in this letter, however, I do not think there is any need to be pessimistic about the future of the industry in that area. The inquiry showed that employers were carrying out the necessary technical developments and production adjustments to enable them to meet the changing pattern of demand and it would be inadvisable to magnify the significance of recent shifts in employment in the industry which are in many ways a necessary re-adjustment to present demands.

"There is, moreover, a wide variety of other industries in the area which are expected to provide a substantial number of additional jobs for men in the next few years. The resilience of the local economy has been demonstrated by the relative ease with which the male workers who left the light-castings industry were rapidly absorbed in employment elsewhere. Unemployment amongst men is now at a low level, and, in fact, the light-castings industry itself complains of a shortage of skilled workers and urges the need for new entrants to the industry.

"On the other hand, there is an admitted need for additional employment opportunities for women and the Government will do its best to encourage new projects (requiring mainly female labour) to set up in the area.

"I think that this inquiry has been well worthwhile as it has given us a clear picture and, I hope, allayed many doubts. I will, however, continue to watch the position carefully."

MR. C. W. PARKES, president of the National Brassfoundry Association, was the guest of the Midlands branch of the Association at its annual dinner-dance in Birmingham on February 23.

TO COPE with increasing business the London offices of the British Wedge Wire Company, Limited, Warrington, makers of "Wedco" mechanical handling equipment, have been moved from 687, Finchley Road, N.W.2, to more commodious premises—Elmswood House, Bounds Green Road, N.11. The move also affects another member of the "Wedco" organization, Modern Mechanisation, Limited. The telephone number is Bowes Park 8442 and the telegraphic address, Modmec, London, N.11.

BRADLEY & CRAVEN, LIMITED, plan to extend the foundry at Dewsbury Road, Wakefield.

MR. G. OSTBERG, of Stockholm, in the February issue of *Gjuteriet* has summarized his article on "Dephosphorization of Cast Iron by the Addition of Mg, Ca and Ce under Reducing Conditions" in the following statement:—Laboratory experiments show that the phosphorus content of cast iron can be lowered to some extent by addition of Mg, Ca and Ce as pure metal, alloys or compounds. Qualitative evidence of phosphorus in the refining of slag was obtained. The theoretical and practical aspects of the process are discussed. At present the practical application seems to be limited to the dephosphorization of ferro alloys.

Innovations in a Valve Works

Developments at Gummers, Limited

The application of general principles associated with improved productivity in an old-established foundry is not easy—shops have to be adapted, prejudices overcome, and labour conditions reorientated. Thus, much credit goes to the management of Gummers, Limited, Effingham Valve Works, Rotherham—a family concern, dating back to 1871—for the steps they have taken in recent years to get increased output from restricted space and to do so under better working conditions.

Gummers, Limited, are well known to readers as contractors for the furnishing of washing and bathing facilities for foundry workers. Indeed, they are pioneers in this effort, as just after the first world war they installed the first pit-head baths.

Nowadays, the works employ about 400 people, manufacturing all types of valves; boiler mountings; water fittings and Thermostatic valves for schools and hospitals, etc. To carry on this trade, there have been built up well-equipped patternshops, foundries, machine-, electro-plating and finishing-shops, packing and storing departments. Whilst, no doubt, improvements have been made in other departments, this article is confined to foundry developments. An impetus was given to the notion of developing the foundry when Mr. Leonard Gummer was invited to join the Brassfoundry Productivity Team, which visited America, and subsequently issued an excellent report on conditions there.

General Layout

The general layout of the foundry is shown in Fig. 1. Melting is carried out in a battery of six 150-lb., oil-fired Morgan furnaces. The melting area is surrounded by a canopy for fume extraction. This is very effective and for its functioning three fans of 15 total h.p. are used. When making very heavy castings, additional metal can be brought in from an adjoining shop equipped with a 250-lb. Morgan tilting furnace. Moulds are made on four Tabor jolt-ram-strip machines—one being held in reserve. Additionally, a jolt-squeeze-turnover machine of the Osborn type is also in service. Each half-mould coming from the machine is stacked on a table conveniently placed. From the side remote from the machine, the half-moulds are taken off by a man who cores-up, closes, and places them on the gravity roller conveyor, which brings them in front of the furnaces for casting.

Sand System

The cast-up moulds then go forward on to a small-size Sterling knock-out, from which the boxes go back to be stacked alongside the moulding machines, whilst the castings are loaded into steel barrows for transferring to the fettling shop. The sand passing through the knock-out falls on to a ½-in. mesh sieve, below which is situated the hopper of a Pneulec Royer sand-conditioning machine. This apparatus discharges the sand to the storage area. Beside this, there is a mill for the preparation of facing sand.

The whole layout is the essence of simplicity, and, whilst there is still a certain amount of manhandling of boxes and sand, yet the sand floor, the carrying and laying out of lines of boxes and their knocking-out on site and transfer back to the machines, all have been eliminated. It is a type of layout that can be emulated with advantage by large numbers of non-ferrous founders.

Shell Moulding

With a view to economizing both floor space and machining costs, Gummers have created a shell-moulding department. Having excellent pattern-shop facilities, there was but little trouble in the provision of patterns. Fig. 2 shows the general layout of the shop, the plant for which has been designed, manufactured and installed by the firm's own staff. Fig. 3 shows a typical heated pattern-plate, carrying a large number of patterns, being

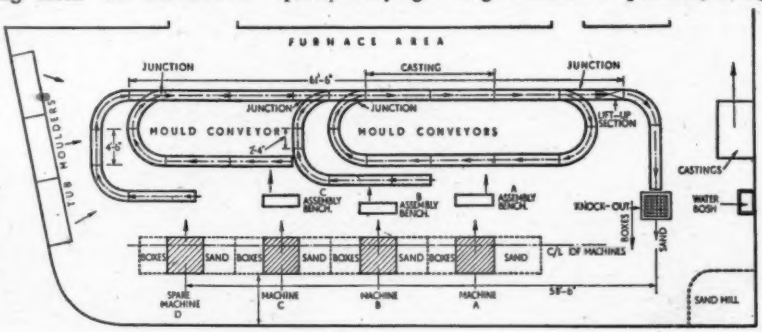


FIG. 1.—*General view of the light mechanized section at Gummers, Limited, modelled on the Brassfoundry Productivity Team's recommendations.*

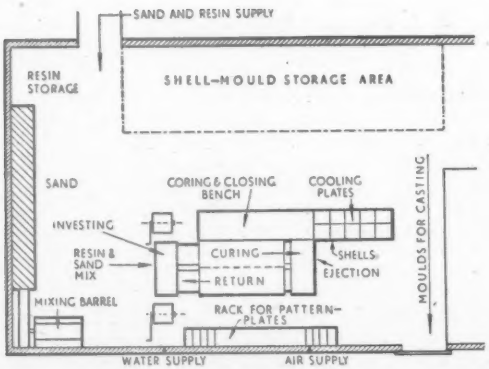
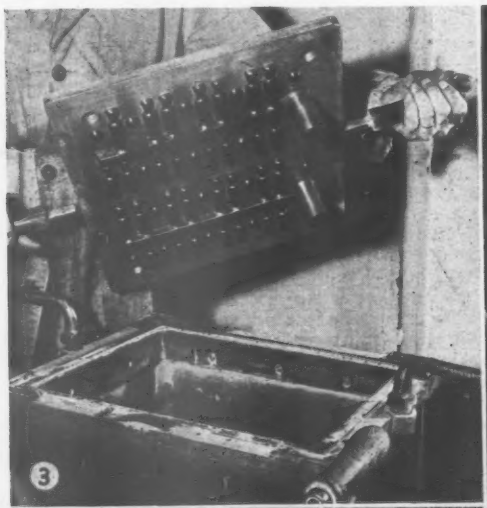
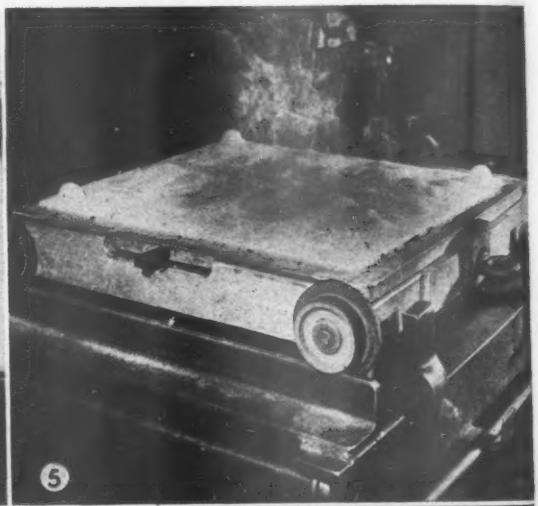


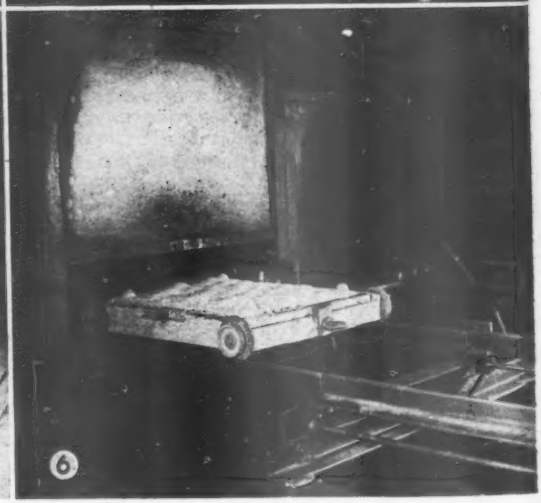
FIG. 2 (*left*).—*Layout of the shell-moulding shop at Gummers, Limited.*

placed on the top of the dump-box. At the moment, pre-coated sand is being used, after many types of both resins and sands have been tried. The dump-box is closed by the movement of two levers.

FIGS. 3 TO 6.—*Stages in the manufacture of shell moulds at the Effingham Valve Works of Gummers, Limited. Fig.* 3 *shows the heated patternplate being placed on the dump-box; Fig.* 4 *illustrates the investment side of the plant; Fig.* 5 *the shell mould still hot after investment; and* FIG. 6 *a mould entering the oven for curing.*







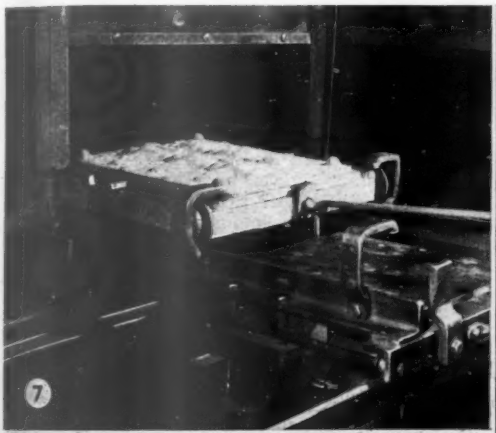
Two girls operate the machine, and the provision of a clock is ample to ensure that investment time is according to instructions. The dump-box is rotated by hand, and after investment, the pattern is slid to the front of the oven, as shown in Figs. 4 and 5. In Fig. 6, it is shown entering the oven, the door of which is pedal controlled. After a predetermined time, the cured biscuit, on its pattern-plate, is withdrawn from the oven, using the eyebolt shown in Fig. 7. The foot-pedal-operated striper is shown in Fig. 8 and the stripped shell is shown in Fig. 9. The carrier has a well-placed handle for sliding it to the return side of the oven for the continuing of the cycle. Fig. 10 shows a pair of typical shell-halves, which are turned out without undue hurry at the rate of 30 complete moulds per hour.

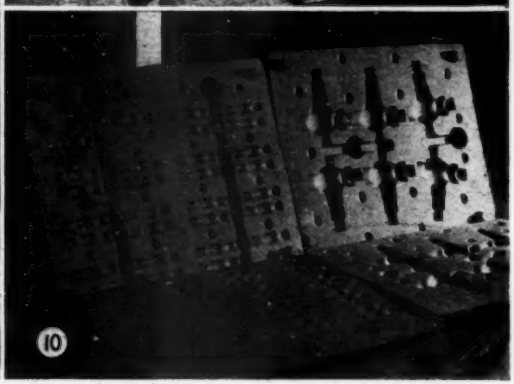
Closing and Pouring

After cooling, the shells are stored until required for assembly and casting. A variety of methods of assembling the two halves has been tried, but,

(*Continued on page 236 at foot of col. 1*)

FIGS. 7 TO 10.—*Further stages in shell-mould production at Gummers; Fig.* 7—*cured mould leaving the oven for stripping; Fig.* 8, *stripping—effected by a foot-pedal-operated compressed-air mechanism—the stripped shell being shown in Fig.* 9. *Fig.* 10 *shows the finished half-moulds ready for coring-up, assembly and casting.*





Influence of Iron and Manganese on Alpax

Mr. Claude Mascré, in a paper which he presented to the Florence Congress on "Influence of Iron and Manganese on the Alpax (Silumin)-type of Alloy," has drawn the following conclusions:—

For primary A-S.13 (alpax) the French standard specification A 57-702 allows a maximum iron content of 0.75 per cent. The results obtained during the course of the research reported show that this content marks the lower limit of the dangerous zone. Founders should in their own interest avoid approaching it and take every precaution to exclude iron in making of the alloy.

For secondary Alpax, which carries an iron content equal to or greater than 0.75 per cent., it is necessary to limit the noxious influence of this element on the mechanical strength, machinability and soundness of castings. To this end, the outstanding remedy to apply is to increase to a maximum the speed of solidification of the castings. Whilst this is deemed to be indispensable, additionally, the precaution should be taken to carry out the modification treatment with circumspection.

However, if the castings still be defective, it is necessary to add manganese to the alloy according to the formula

$$\text{Mn per cent.} = 2 \times (\text{Fe per cent.} - 0.5)$$

Generally speaking, it is wise to confine Alpax alloys of high iron content for castings which can carry an excess of this element, that is to say, mostly to castings made as pressure-die-castings or to thin castings made by the gravity-die-casting method.

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(*Continued from p.* 235)

during the writer's visit, wing bolts and D clamps were being used.

The economy of space of the shell-moulding process was well shown, as the shells stocked vertically in a comparatively small area would have covered a very considerable floor space. With the threat of upwards re-valuation for rating purposes, space is becoming increasingly important.

The furnace in this section for melting the metal is one of the newer type of small Sklenar units, which permits of baling out, using a ladle. Metal losses are reported to be quite low. Not a great deal of difference is called for in the gating systems when changing over to shell-moulding for the class of work being turned out. The skin of the castings is such that only a very light skin machining is required. It should be remembered that much of the production of components is electro-plated—a process which demands a fine surface-finish.

BRUSH-BAGNALL TRACTION, LIMITED, Loughborough, has now started delivery to the Steel Company of Wales, of seven Diesel/electric shunting locomotives. They are of 300 horse-power, and weigh 44 tons each.

Crane Hooks and Ladle Gear

A number of breakages of crane hooks and ladle gear in service in German steelworks have been investigated recently.* In general, the cause of the failures was found to be due either to a material susceptible to ageing, or due to a weakened cross-section (a design fault) or to unsatisfactory welding and heat-treatment during fabrication. Some experiments were also carried out to determine to what extent the hooks and suspension gear could become heated by the molten metal. Results indicated that on surfaces most subjected to radiation, the temperature may rise to 150-250 deg. C. The use of a radiation shield is thus to be strongly recommended. In the light of experience, the investigator drew up a set of rules and recommendations, including:—

(1) In crane hooks and ladle gear, the load-bearing sections should never be welded—in all cases, sharp changes of section are to be avoided, and as far as possible, bored holes also are to be avoided.

(2) Hooks and suspension gear where possible should be protected from radiant heat and overflowing molten material (slag, etc.), by shields.

(3) All crane hooks and hooks permanently attached to ladle gear should be protected from undesirable bending moments by being easily rotated when under load.

(4) Ladle hooks should be equipped with safety catches over the mouth and with protective plates at the point where impact is likely to be severe.

(5) Suspension members, ladle hooks, etc., which are subjected to a load of more than 20 tons weight should be of laminated construction.

(6) Hooks and all suspension gear should be made from a good normalized steel, resistant to ageing, with a tensile strength of 26 to 32 tons per sq. in.; laminated items should be in boiler-plate steel.

(7) All material selected for the manufacture of crane hooks and ladle gear must be free from segregation, cracks and other faults and also be taken from the ingot at a position well away from the head.

(8) Crane hooks and ladle gear must be handled carefully—it is particularly important that they are not subjected to bending or any sudden shock and violent shock-loads and that they are carefully assembled and dismantled when required.

(9) All hooks and ladle gear in service must be examined regularly for signs of cracking, distortion, or excessive wear—this should be done thoroughly at least once a year; in the case of laminated members an overhaul once every three years is sufficient.

(10) Directly any signs of cracks, severe wear or distortion are noticed that ladle should come out of service at once and remain so until the faulty item has been replaced—in the case of severe distortion, the repaired material should be given a stress relieving annealing treatment.

(11) A proper record book should be on hand in which details of all repairs and replacements and records of service are kept up-to-date.

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* G. Will, *Stahl und Eisen*, August 12, 1954.

Cupolas in Steelworks Practice

The steel industry is evincing increasing interest in the possibilities of the cupola —especially the hot-blast system. By charging liquid cupola metal at high temperature into open-hearth furnaces worthwhile economies have been achieved, particularly where the cupola charge is made up of cheap raw materials.

Two articles* on cupola practice used in conjunction with open-hearth furnaces were reviewed by Mr. Mallevialle in a publication issued by the French *Centre de Documentation Siderurgique*. The first, an article of German origin, referred to a cold-blast cupola. It was installed during the last war and starting off with pig-iron and scrap produced an iron with from 2.5 to 3.5 per cent. carbon. It was turned into an open-hearth furnace and used to the extent of 30 to 35 per cent. of the total charge. The sulphur content ranged between 0.10 to 0.25 per cent. and it was necessary to desulphurize with soda ash, which brought about cooling of the order of about 180 deg. C. It was found necessary to attach to the installation a small gas-heated receiver mounted on wheels.

In another installation, a 40- to 44-in. dia. cupola produced 6.2 to 7.0 tons of metal per hour starting off with a melting charge of 30 per cent. small scrap and 70 per cent. refined iron. It used 140 Kg. (308 lb.). Again, a small coke-oven-gas-heated receiver, employing air preheated to 420 deg. C., gave a slightly superheated iron. No desulphurization was practised.

These two examples show that the cold-blast cupola has as a major drawback the production of an iron of insufficiently high temperature, from which arises the necessity of having irons high in C and Si to maintain fluidity. Desulphurization is not easy, because of the cooling to be associated with the process.

American Cold-blast Installation

However, an American article describes a high-production installation using five, large, cold-blast cupolas which have given satisfaction. The Harrisburg steel plant of the Barium Corporation has five furnaces of 150 tons capacity.

The metal charged into the open-hearth furnaces consists of 25 per cent. of cupola-melted metal, 15 per cent. of solid pig-iron, and 60 per cent. of scrap. The furnace production using cold charges was 7½ tons an hour but when using the liquid cupola metal it exceeds 10 tons an hour.

The three cupolas used are of 65-in. dia. at the tuyere level. The blast is blown into each cupola by a fan actuated by a 350 h.p. motor giving 340 cub. metres of air per min. The plant uses 16 tuyeres and the fusion zone is water-cooled. The lining is made up of silica-alumina bricks and the tap-hole from a block of carbon. The normal campaign is about 70 to 80 hours. Each cupola melts 15 tons per hour and the control of production is such that the plant yields sufficient metal to provide the 25 per cent. of the open-hearth charge which is required. Normally, the charge consists of ¾ scrap and ¼ pig-iron and 88 lb. of limestone is used per ton of iron melted. The coke consumption is of the order of 396 lb. per ton of iron. A small addition of ferro-silicon is made.

The average composition of the iron is:—C, 3.0; Si, 0.7 to 0.9; Mn, 0.3 to 0.4; S, 0.15 to 0.275; and P, 0.15 to 0.25 per cent. The temperature of iron at the spout is about 1,510 deg. C. The iron goes into a 150-ton mixer, heated by fuel oil, there it is desulphurized by 14 to 18 lb. of soda ash and the sulphur content falls to 0.045 per cent.

The use of these cupolas is justified by the increase in production, a lowering of fuel consumption, a more regular operating cycle, and easier hearth maintenance in the steel furnaces. This largely compensates for the extra cost of just over 10s. per ton of the metal charge. The cupola iron works out at 26s. per ton higher than the cost of the pig-iron it displaces. The installation has given every satisfaction and a similar installation is envisaged for a subsidiary company.

Hot-blast Cupola Application

By and large, the cold-blast cupola does not allow of the production of low-carbon irons, due to insufficient temperature. Low-carbon-content irons do permit higher liquid charges in the steel furnaces and are thus more favourable for the increase in production from open-hearth furnaces. Thus, without changing the carbon content of the liquid charge, and so without increasing the refining time, one can charge 7,920 lb. of liquid iron carrying 2 per cent. C in place of 440 lb. of iron with 3.5 per cent. carbon.

This is why the hot-blast cupola, which in 1952 was scarcely used in the foundry, shows a distinct interest for the steelworks and several installations have been made, especially in Germany. They possess the following advantages over the cold-blast system:—

(1) Increase in production, varying from 40 to 75 per cent., with blast temperatures of from 400 to 700 deg. C.

(2) A 30 to 50 per cent. coke reduction.

(3) Higher metal temperature at the cupola spout of about 100 to 150 deg. C. This permits the use of a range of irons suitable for the foundry, the converter, the open-hearth or the electric furnace. For the open-hearth, it is possible to cast low-carbon, low-silicon irons which are very fluid and well able to undergo desulphurization, using soda ash. Furthermore, oxygen enrichment of the blast allows a still further increase in temperature of the iron at the spout.

* "Possibilities of using the Hot-blast Cupola in Steelworks" by K. Guthman, *Stahl und Eisen*, 72, No. 10, 545—561; "Cupola Hot Metal increases Steel Production, Cuts Ingot Costs" by D. I. Brown, *Iron Age*, *169*, No. 9, pp. 104-107.

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(4) The proportion of scrap in the cupola charge can go up to 100 per cent., thus lowering the cost price.

(5) Basic-lined cupolas make possible the use of basic slags, as a result of which, low-quality, rusty scrap can be used, as well as turnings (of which direct use in the open-hearth would be out of place), all of which makes for a relatively cheap charge.

In short, the hot-blast cupola can give a final product low in silicon and of controlled C, P and Mn contents and at high temperature—1,550 to 1,600 deg. C. It can thus be called upon to play a major part in metallurgical undertakings.

Blast Heating

In a modern installation, the cupola throat is closed and a certain proportion of the gas is used for heating the recuperators. This gas—according to the Wärmestelle of Dusseldorf—has an average content of 13 to 14 per cent. of CO and 12.5 per cent. of CO_2, with a calorific value of less than 45,000 B.Th.U. per cub. ft. to which is to be added the sensible heat of about 500 deg. C. It passes

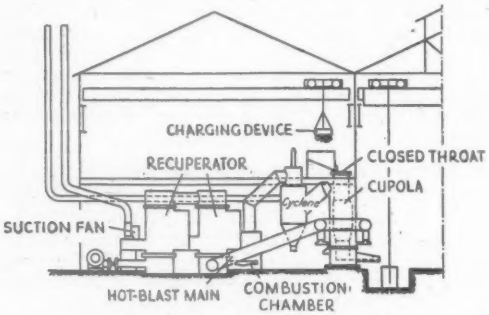

FIG. 1.—*Installation of a hot-blast cupola for a steelworks in the Liége area.*

through a cyclone for purification, then a heat-exchanger of the metal-tube type, preceded by a combustion chamber. The gas is drawn through and across the heat-exchangers and a regulator maintains its pressure at about ½ in. w.g., to prevent any entry of air. The temperature of the blast is thereby carried to between approximately 400 and 500 deg. C.

For this blast temperature, the production capacity of a cupola varies with its diameter at tuyere level. A cupola of about 32-in. dia., produces five tons of iron per hour, while one of 48-in. gives 11 tons per hour. The hot-blast plant occupies a position between the normal cupola and the blast-furnace. It requires close supervision and proper instrumentation.

Performance Data

The German article gives the performance of several installations:—

A Belgian plant at Liége since 1949 has used a hot-blast cupola (Fig. 1), producing 1,200 metric tons of special iron per month. The details of this cupola are:—

Diameter	34 in.
Production	5 tons per hr.
Blast temperature:	
At the recuperator ..	480 deg. C. (average)
At the tuyeres	500 deg. C.
Coke consumption (high, in order to obtain adequate carbon content)	374 lb. per ton.
Production of gas; (closed throat); (35 to 50 per cent. of the gas is used for recuperation); (gas at a calorific value of less than 90,000 BThU per cub. ft.)	about 176,650 cub. ft. per ton of coke.
Temperature of iron at the spout	1,500 deg. and higher.

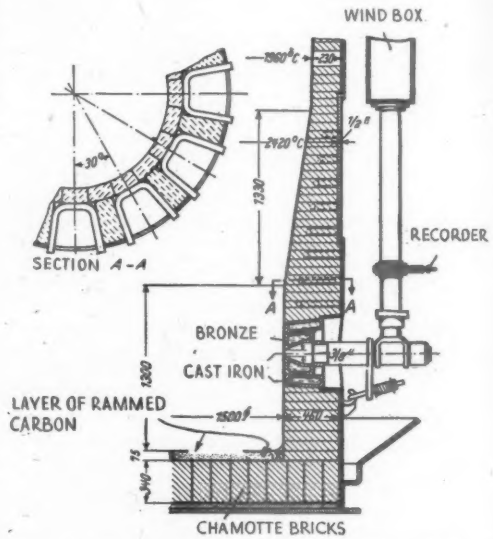

FIG. 2.—*Part sections of a hot-blast cupola in an American open-hearth steelworks.*

Charge:

Steel scrap plus pig-iron .. 80 to 85 per cent.
or steel scrap plus Fe-Si .. 100 per cent.

Irons obtained: C 2.8 to 3.6; Si 1.8 to 2.30; Mn 0.5 to 0.8; P 0.05 to 0.10; and S 0.02 to 0.07 per cent.

An article published in the *Iron Age* and referred to in the German publication gives the results obtained in three American steelworks. The installations have been carried out by using two cupolas to make iron for charging 7,000 to 9,000 tons per month as liquid metal into their open-hearth furnaces. These cupolas were tapped into 40-ton ladles and charged direct into the open-hearths. The cupolas were 60 in. dia. (Fig. 2). The charge was made up of about 67 per cent. steel scrap and 33 per cent. of pig-iron; 3 per cent.

of limestone was used. These cupolas have six tuyeres, and the furnace ran for six months without interruption. They were more like blast furnaces than cupolas.

German Plant

The German article referred to quotes a modern plant installed by the steelworks of Knorr Bremse at Volmarstein. The furnaces occupy a building of 50 by 25 ft. with a height of 40 ft. The plant includes two 30-in. dia. (at tuyere level) cupolas, with a receiver, a cyclone for gas purification and a Metalwork recuperator having a pre-combustion chamber. Tests have been carried out with 100 per cent. cheap scrap charges. A portion of the iron was desulphurized with soda ash and converter blown. The following results were obtained:—

Cupolas.

Diameter of the well	30 in.
Diameter of the stack	38 in.
Blast temperature:	
At the recuperator	480 deg. C. (average)
At the tuyeres	400 deg. C.
Cupola charge	100 per cent. scrap +5 per cent. limestone.
Coke consumption	242.8 lb. per ton (metric).
Production	4.65 tons (m.) per hr.
Temperature of the iron:	
At the spout	1,570 deg. C.
From the receiver	1,500 deg. C.

Composition of the iron: C 1.78 to 2.18; Si 0.78 to 1.18; Mn 0.14 to 0.38; S 0.11 to 0.14; and P 0.11 to 0.15 per cent.

Composition of the slag: SiO_2 49.6; FeO 10.1; Fe_2O_3 0.35; and S 0.1 per cent.

The high-sulphur content is due to the acid lining of the cupola, but it is deemed possible to obtain a purer metal through using a basic lining. This would allow of operating under a lime slag with desulphurizing potentialities. The object sought is to provide a metal of low sulphur content, starting off with cheap scrap and mediocre coke. In such cases the lining is generally made from a mixture of rammed tar/dolomite or dolomite bricks.

Finally, the German article referred to two further installations erected in 1932, where a hot-blast temperature of 700 deg. C. was used.

RECENT GERMAN INVESTIGATIONS

The problems of metal composition when working the hot-blast cupola to melt scrap for the open-hearth furnace have been extensively investigated also by Kootz and Rellermeyer in Germany and their results have been published recently.* An experimental unit has been in operation at the August-Thyssen works at Duisburg-Hamborn, a cupola in general similar to those described earlier, with a hearth diameter of about 40 in. The blast temperature varied from 500 to 700 deg. C. and the output of metal from 5 to 9 tons per hr. A total of six experimental campaigns have been undertaken and reported upon.

Practical Difficulty

A practical difficulty which is unavoidable when using the hot-blast cupola to supply metal for the open-hearth furnace is that the carbon content of the melted metal increases as the temperature rises. Thus to some extent the advantages which are offered to the open-hearth steelmaker by being able to charge some of his "scrap" in the liquid form are offset by the fact that the amount of refining necessary is also increased.

These investigators have shown that the carbon content of the metal rises roughly at the rate of 0.5 per cent. C for every extra 50 deg. C. temperature rise. Also (unless the metal be contaminated with silicon), the minimum carbon content which is possible is about 2 per cent., since anywhere below this the metal comes dangerously close to the liquidus of the C/Fe system, *i.e.*, the metal is likely to form a heavy skull in the runners and ladles.

If some ferro-silicon be added to the cupola along with the scrap, then it is possible to tap a metal with a slightly lower carbon content, but of course if the metal is to be charged to the open-hearth furnace this again may be disadvantageous. The Authors' results indicate that at 1,400 deg. C. an addition of 2 per cent. Si can lower the average carbon content by some 0.5 per cent. from, say, 2.5 to 2 per cent. At zero silicon, the saturation figure for carbon in iron is just under 5 per cent.; at 2 per cent. silicon this falls to 4 per cent.

"Blast Cross-section"

A factor which exerts a powerful influence on the carbon content actually obtained is the ratio between the cross-section of the tuyères and the cross-section of the hearth, what is called the "blast cross-section" (*Blasquerschnitt*). To obtain a carbon content of under 2.5 per cent. this figure should not exceed 5 per cent., *i.e.*, the blast must enter the vessel through small cross-section tuyères at a rapid velocity. The Authors' results and those obtained by other investigators in the same field show that this feature is very significant. At 40 per cent. "blast cross-section," the carbon content of the metal (smelted from 100 per cent. scrap with 15 per cent. coke and tapped at 1,400 deg. C.) can rise almost to saturation point, *i.e.*, 5 per cent. C. Similarly, the blast velocity must be high. Raising the blast input speed from 10 metres per sec. to 80 metres per sec. (under the same conditions) lowered the carbon content from 3 to 2 per cent.

Sulphur Problem

A further problem when using the hot-blast cupola to provide the open-hearth furnace with some of its "scrap" charge is that of sulphur. A certain degree of pick-up is always liable to occur from the sulphur in the coke. Here, high tapping temperatures benefit desulphurization—thus the

* Th. Kootz and H. Rellermeyer. Arch. f.d. Eisenhüttenwesen. Jan. 26, 1955. (1) p. 1.

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advantage of high temperature with the corresponding disadvantage of a high-carbon metal may in practice be offset by the better quality metal obtained from the point of view of sulphur content. High temperatures also give slags lower in iron content, which may be an important economic factor in recovery.

The experiments performed at Duisburg-Hamborn are extremely valuable in showing the general problems which are likely to be associated in practice with the use of hot-blast cupolas as a means of melting part or all of the scrap charge for open-hearth furnaces. The Authors have also performed a few trials regarding the pre-refining of the tapped metal with oxygen in the ladle before it is passed to the steelmaking furnaces. To remove 1 per cent. of carbon from the iron (2.5 → 1.5 per cent. C) it was found that the oxygen consumption amounted to about 350 cub. ft. per ton. The trials were performed on 8-ton batches, the oxygen flow amounting to about 50 cub. ft. per min. Under these conditions, this operation is easily performed by means of small and light hand-lances, and it offers a means whereby some of the disadvantages of using cupola-melted iron in the open-hearth can be circumvented.

Film Reviews

Steelmaking. The British Iron & Steel Federation last week released three additional films to the half-dozen already available. They have been made to illustrate the syllabus of City and Guilds of London Institute's "Iron and Steel Operatives' Course." The three now released are "Electric Furnaces," "Furnace Control" and "Bessemer Conversion." The electric furnaces—both arc and induction—are beautifully illustrated and their operation is lucidly explained. This is essentially a film well worth showing to steelfoundry apprentices. The next one—"Furnace Control"—deals with instrumentation and vividly illustrates the great progress made in the iron and steel industry. It would be profitable for the high-grade technicians and foundry executives to see this film, as it clearly shows the way to the instrumentation of foundry melting furnaces and potential economies.

The third film, "Bessemer Converter" deals with the larger type of vessel, such as is used in steelworks' practice and thus is of only general interest for the foundry industry. These films, which run for about 15 min. each, are available to the organizations connected with our industry on application to the Training Department of the Federation at Windsor House, 45, Victoria Street, London, S.W.1.

Modern Motor Manufacture. Ferranti, Limited, have released a film showing the quantity-production methods they use for electricity-meters manufacture. The first sequence shows the making, by pressing, of the plastic cases, but omits to show the internal casting which carries all the bits and pieces. No doubt its inclusion would have unduly lengthened showing time—12 min. The film was made, it is understood, in a fortnight by Technical & Scientific Films, Limited.

This firm was also responsible for two others "Home and Away No. 1" and "Overdrive." The former has been made for the Babcock and Wilcox organization as a sort of house organ for exhibition in the cinemas situated near to the works. It features such events as the works' football team playing a local club, the Scottish Industries Exhibition and in fact just those features normally to be found in a company's employees' magazine. The "Overdrive" film has been made for Laycock Engineering Limited and is intended for showing to the general motoring public.

Wholesale Prices Up in 1954

The fall in wholesale prices after the Korean war seems to have ended in the early months of 1954. During the rest of the year there was a rising trend in the prices of most basic materials and manufactured products which has continued into 1955. This is stated by the Board of Trade in its annual review of the movement of wholesale prices during 1954. After falling 15 per cent. in 1952 and 7½ per cent. in 1953, prices of basic materials rose by nearly 3½ per cent. in 1954 to finish the year 46 per cent. higher than they had been some five and a half years previously, when the new series of Board of Trade wholesale price index numbers commenced. By contrast, producers' prices for manufactured products—after falling 1½ per cent. in 1952 and just over 1 per cent. in 1953—rose by only 1½ per cent. in 1954, to finish the year only 26½ per cent. higher than in the middle of 1949.

The much smaller price increase over the five and a half years in the case of manufactured products was due mainly to the fact that wages rose less steeply than material prices during that period. Since the end of 1952, however, in a period in which prices of basic materials have on average fallen, increases in wages have played a relatively more important part in tending to raise manufacturing costs; the fact that significant increases in the prices of manufactured products have, in general, been avoided during these two years is largely attributable to the greatly increased output and improved efficiency of manufacturing industry, says the Board.

Dealing separately with the trend of prices for materials, The Board of Trade points out that most materials used by industry rose in price during 1954. Basic material prices increased by nearly 3½ per cent., while those of building, mechanical, and electrical engineering materials rose by approximately 3, 5½, and 7 per cent., respectively. Among the individual materials whose increased prices mainly accounted for the general rise in prices during the year were rubber, with an increase of 45 per cent., and copper, with an increase of 21 per cent. The rise of rather less than 3 per cent. in iron and steel prices and of between 10 and 20 per cent. in the prices of many non-ferrous metal items during the year greatly raised the level of material costs in the engineering industries.

COVENTRY city magistrates on February 23 fined the Earlsdon Engineering Company, Limited, of Hearsall Lane, Coventry, £10 after the firm had pleaded guilty to failing to ensure that a machine was securely fenced. An employee, Christine Power, had her hair entangled in a revolving stock bar.

AT THE ANNUAL MEETING of the Allied Ironfounders' Angling Club in Falkirk, there was a good attendance of members to hear Mr. J. W. Melville's review of the club's activities during 1954. He extended his congratulations to Mr. A. Reid, the Hill Cup winner for the year.

Growth of Foundry Coke Demand

Merchants' London Dinner Report

Reference to the growing strength of the Foundry Coke Merchants' Association was made at the annual banquet of the association at the May Fair Hotel, London recently, and briefly reported last week. Mr. R. J. McDonald, the chairman, said that his audience represented a remarkable cross-section of some of the most important industries and trades of this country—industries which were largely responsible for the apparent prosperity of the country. Foundry coke merchants supplied, worked with, and almost lived with some of the wealthiest industries of the country; and yet they were among the poorest. He was hopeful that his remarks would not fall entirely on deaf ears.

Until quite recently, he continued, he was under the impression that the demand for foundry coke must be diminishing in favour of other fuels and sources of energy, such as electricity and oil, and, indeed, he was firmly convinced that that was so in certain directions. However, he was informed on the highest authority that the demand for foundry coke was ever on the increase—an extremely healthy sign.

Castings Production

Mr. J. Y. Feggetter, marketing officer (carbonization and briquetting) of the Durham Divisional Coal Board, said the production of iron castings was increasing. In 1953 it was 3,630,000 tons, and the indications were that for 1954 it would prove to be about 3,740,000 tons, a steady increase, which was very satisfactory indeed, not only for the producers, but also for the merchants. Producers were allowing for the increase and were keeping the production of coke in line with those developments.

Proposing the toast of the association, Mr. John Bell, president of the Institute of British Foundrymen, conveyed the greetings of the Institute and expressed the hope that the two bodies would continue to help each other in the future. Nowadays something like 70 per cent. of the foundry coke produced in the United Kingdom was supplied through the merchants. It indicated that the relationship between the merchants and the producers must be a happy one; and he presumed it was the desire and policy of the Association to develop and increase that good will by paying close attention to the needs of the users.

It was known that coke varied as between district and district. The problems of coke quality had exercised the minds of the Institute of British Foundrymen, which had appointed a committee to consider matters such as its composition, consistency, ash content, and carbon and sulphur pick-up by the metal. That provided also an opportunity for the merchants to help. By working together with the producers and users, the merchants could help foundrymen to get the best out of the available coke supplies.

Mr. John Charrington, who responded to the toast, said the Association owed a very great debt of gratitude to Mr. Arnold Carr, who was its first president in 1941 (when it was founded), and had steered it through very difficult days during the war and in the post-war years of nationalization. He also paid tribute to Mr. John Selby, a member of his company, chairman of the London Foundry Coke Merchants' Association, which had preceded the national association, having been set up in 1939.

Parliamentary

Colvilles, Limited

Written answers were given by MR. R. A. BUTLER to three questions by MR. LAWSON concerning Colvilles, Limited. He said that the figure of total net assets of Colvilles, Limited, including its subsidiaries, was £15,705,000 in the group balance-sheet as at December 31, 1950, and £22,180,000 as at October 2, 1954. These were the nearest dates for which such figures were available. The compensation for the company's total share capital on nationalization was approximately £10,000,000. Dividends paid on the share capital from the date of nationalization to December 31, 1954, net of tax, totalled about £1,250,000; in addition, the company paid a special dividend of approximately £6,000,000 net to the Iron and Steel Holding and Realization Agency in December, 1954, which the agency applied in subscribing for fresh securities issued by the company. The Iron and Steel Corporation did not make any loans to or additional investment in the company during this period.

Asked what profit or loss the Iron and Steel Holding and Realization Agency expected to make when Colvilles had been completely resold to private investors, the Chancellor said that the gross proceeds of the sale to the public of the ordinary shares of Colvilles, Limited, were £13,000,000, and this in itself exceeded by nearly £3,000,000 the cost of the agency's investment in the company. In addition, the agency held debenture stock and preference shares of the company to a nominal value of £14,000,000, of which £2,000,000 had been paid up; the balance would have to be met in due course and would fall to be recovered when these securities were sold. No exact figure of profit could be given until this sale had taken place.

Cable Makers' Assurances

MR. SELWYN LLOYD, Minister of Supply, replying to MR. PALMER, said that the Cable Makers' Association and the Covered Conductors' Association had assured him that they had, as requested by the Government, brought their trading arrangements as from January 1 this year into conformity with the conclusions reached by the Monopolies Commission, subject to the two reservations explained in his predecessor's statement of May 20.

The Minister said that cable makers had also assured him that prices charged to users other than the British Electricity Authority for mains and super-tension cable had borne, and would continue to bear, a direct and reasonable relationship to those charged to the BEA. The association had stated with regard to telephone cable that it was still negotiating prices with the General Post Office.

Pneumoconiosis and Silicosis

In 1953, the Silicosis Medical Board dealt with 465 applications under the Workmen's Compensation Acts for certificates of death in respect of coal miners, said MR. OSBERT PEAKE, Minister of Pensions and National Insurance. He also told MR. J. GRIFFITHS that in 330 of these cases it was certified that death was due to silicosis or pneumoconiosis, and in 135 cases it was certified that death was not due to the disease.

"I regret that the information asked for is not available," said the MINISTER, when the REV. LL. WILLIAMS asked how many persons suffering from pneumoconiosis in the South Wales region of the National Coal Board died in 1954, and in how many cases death was solely due to pneumoconiosis.

Company News

NORTON INDUSTRIES, LIMITED, ironfounders, engineers, and scrap-metal merchants, of Wolverhampton—A first and final dividend of 10 per cent. for the year ended October 31, 1954, is announced. Group profit amounted to £36,413, compared with £40,847 in the previous year.

VONO INDUSTRIAL PRODUCTS, LIMITED—Renounceable allotment letters have been posted in respect of the scrip issue of 1,000,000 ordinary shares of 5s. each in the proportion of one for four. Circulars have also been despatched offering 1,050,000 5 per cent. cumulative preference shares of £1 each for cash subscription.

SAUNDERS VALVE COMPANY, LIMITED—The company has entered into a contract to purchase, for cash, the £202,960 share capital of Goulds Foundries, Limited, Newport, at a price of 23s. 9½d. per £1 share. The purchase is being financed out of existing resources, but the directors have under consideration the raising of additional capital.

RICHARD THOMAS & BALDWINS, LIMITED—In their report for the year to October 2, 1954, the directors state that the demand for the company's products was in excess of supplies. Satisfactory progress was made last year with regard to the modernization programme, and expenditure estimated at £1,400,000 on the continuous sheet-galvanizing unit at Ebbw Vale has been authorized.

POWER-GAS CORPORATION, LIMITED—The board is raising the distribution on the £2,000,000 one-class capital by 2 per cent. for the year to September 30 last. A dividend of 14 per cent. is recommended, against the 10 per cent. plus 2 per cent. bonus payment for 1952-53. Group trading profits are slightly lower, but as the result of a substantially reduced provision for taxation the net balance attributable to the corporation is up from £235,286 to £300,525.

MINERALS SEPARATION, LIMITED—The directors announce the creation of a further £250,000 4½ per cent. debenture stock, 1969-79, which is being privately placed at par by the company's brokers. Consent of the Capital Issues Committee has been obtained. The new stock will rank with the £250,000 debenture stock already issued, except that interest will be payable from the date of subscription. No quotation will be sought at present for the original issue or the proposed further issue.

ENGLISH ELECTRIC COMPANY, LIMITED—The directors state that if the offers to holders of Vulcan Foundry, Limited, and Robert Stephenson & Hawthorns, Limited, are accepted by the requisite majorities, all but £947,715 ordinary capital will have been issued. In view of potential development the directors recommend that the authorized capital be increased to £25,000,000 by the creation of a further 10,000,000 £1 ordinary shares. They add, however, that no further issues are at present contemplated.

BLYTHE COLOUR WORKS, LIMITED, vitreous enamel manufacturers, of Stoke-on-Trent—The directors recommend a scrip issue of one 4s. ordinary share for each ordinary share of 4s. already held, to be made to members on the register at the close of business on March 15. Permission has been granted by the CIC. The new shares will rank for all dividends declared in respect of any period after December 31, 1954. It is proposed to issue renounceable allotment letters. The directors emphasize that the increase of capital does not imply the distribution of larger sums by way of ordinary dividends.

WESTINGHOUSE BRAKE & SIGNAL COMPANY, LIMITED—Very substantially increased production was responsible for the increase of £345,605 to a record £1,616,392 in the 1953-54 group trading profits. All home and overseas companies made good progress, the parent's order-book remains at a high level, and current trading indicates good results being obtained for 1954-55. In his statement with the full accounts for the 53 weeks to October 2 last, Capt. A. R. S. Nutting, the chairman, says he regards the profit as most satisfactory, particularly in view of the fact that 50 per cent. of products goes, directly or indirectly, to export markets in many of which competition is keen.

Contracts Open

The dates given are the latest on which tenders will be accepted. The addresses are those from which forms of tender may be obtained. Details of tenders with the reference ESB can be obtained from the Board of Trade, Export Services Branch, Lacon House, Theobalds Road, London, W.C.1 (telephone CHAncery 4411, ext. 738 or 771), unless otherwise stated.

ATHERTON, March 14—Iron castings, manhole covers, and street gullies for the year ending March 31, 1956, for the Urban District Council. The Surveyor, Town Hall, Atherton, near Manchester.

AUSTRALIA, March 15—Power cable and cable boxes, for the Townsville Regional Electricity Board. (ESB/3626/55.)

LONDON, N.W.4, March 8—Castings for the period ending March 31, 1956, for Hendon Borough Council. The Borough Engineer and Surveyor, Town Hall, Hendon, N.W.4.

MAESTEG (GLAM), March 5—Iron castings for the year commencing April 1, 1955, for the Urban District Council. Mr Lewis W. Jones, engineer and surveyor, Council Offices, Maesteg.

MIDDLESBROUGH, March 14—Spun- and cast-iron pipes and specials, cast-iron surface boxes, etc., for the year ending March 31, 1956, for the Tees Valley Water Board. Mr. E. A. Morris, clerk of the board, Water Board Offices, Corporation Road, Middlesbrough.

TYLDESLEY (LANCS), March 5—Cast-iron manhole covers and frames and gully gratings and frames for the 12 months from April 1, 1955, for the Town Council. The Engineer and Surveyor, Town Hall, Tyldesley.

URUGUAY, March 10—Zinc slabs, for the Administracion Nacional de Puertos. (ESB/3207/55.)

Increases in Capital

FELCO HOISTS, LIMITED, London, S.W.7, increased by £100,000, in £1 shares, beyond the registered capital of £100,000.

SALISBURY PRECISION ENGINEERING, LIMITED, increased by £50,000, in 5s. shares, beyond the registered capital of £15,000.

MINING MACHINERY, LIMITED, Newcastle-upon-Tyne, increased by £4,900, in 1s. ordinary shares, beyond the registered capital of £100.

HULL & EAST RIDING COAL & COKE COMPANY, LIMITED, increased by £10,000, in £1 ordinary shares, beyond the registered capital of £2,000.

WINFIELDS ROLLING MILLS, LIMITED, Birmingham, increased by £35,000, in £1 ordinary shares, beyond the registered capital of £40,000.

ALLIED COAL & SHIPPING, LIMITED, Glasgow, increased by £75,000, in £1 ordinary shares, beyond the registered capital of £150,000.

CAPE ASBESTOS COMPANY, LIMITED, London, W.1, increased by £1,750,000, in 5s. ordinary shares, beyond the registered capital of £1,500,000.

BRITISH ROLLING MILLS, LIMITED, Tipton (Staffs), increased by £100,000, in £1 ordinary shares, beyond the registered capital of £150,000.

ENGINEERING COMPONENTS, LIMITED, Slough (Bucks), increased by £500,000, in 5s. ordinary shares, beyond the registered capital of £600,000.

E.N.V. ENGINEERING COMPANY, LIMITED, London, N.W.10, increased by £400,000, in 5s. ordinary shares, beyond the registered capital of £600,000.

DRYSDALE & COMPANY, LIMITED, engineers, of Glasgow, increased by £562,500, in £1 ordinary shares, beyond the registered capital of £112,500.

NEWSEND STEEL & TOOL CORPORATION, LIMITED, Sheffield, increased by £200,000, in 5s. ordinary shares, beyond the registered capital of £700,000.

STEIN & ATKINSON, LIMITED, makers of furnaces, ovens, etc., of London, S.W.1, increased by £150,000, in £1 shares, beyond the registered capital of £100,000.

News in Brief

WORK IS IN PROGRESS on extensions to the factory at Eastfield of F. Perkins, Limited, Diesel-engine manufacturers, of Peterborough.

THE SHOP STEWARDS at Leyland Motors, Limited, have presented Sir Henry Spurrier with a solid silver Georgian tea service.

STOREY FOUNDRY COMPANY, LIMITED, has had plans prepared to erect new extensions to the works in Conway Street, Stockport, Cheshire.

PROVISION of three new electric cranes, costing £20,000 each, is scheduled in the Tyne Improvement Commission's £82,000 re-equipment scheme for the Albert Edward Dock.

CONSTRUCTIONAL ENGINEERING COMPANY, LIMITED, announces that as from February 22, its new London address is 81, Gracechurch Street, London, E.C.3 (telephone: MANsion House 5631).

PRODUCTION has begun in part of the new £1,000,000 factory at Daventry (Northants) of British Timken, Limited, bearing manufacturers. Work, which began on the factory about a year ago, is still continuing.

NEW EXTENSIONS to the Murex Research laboratories at Waltham Cross have recently been completed and the department which now covers an area of some 28,800 sq. ft. is one of the most modern and best equipped of its kind in the world.

A SUB-COMMITTEE of eight members has been appointed at a gathering in Manchester of representatives of industry, the universities, and trade organizations to undertake the preparatory work in establishing an industrial museum for the north-west.

BRITISH INDUSTRIES FAIR announce that an award of £200 will be paid to the winner of a contest producing the best "brainwave." Details of the competition are available from the BIF offices, Ingersoll House, 9, Kingsway, London, W.C.2.

MR. W. L. BARROWS, chairman of the Revo Electric Company, Limited, presented gold watches, valued at £6,000, to 251 long-service employees at a dinner and party held at Dudley Town Hall on February 18. The 251 employees among them totalled 7,828 years of service.

THE Federation of Light Metal Smelters announces that its members' average selling prices, to the nearest 10s., for the following alloys during the month of December have been calculated as follows:—LM1, £151 per ton; LM2, £157 10s.; LM4, £161; LM6, £180 10s.

THE STAFF establishment at the Fuel Research Station in 1953-54 was 292, said Mr. Bevins, Parliamentary Secretary to the Ministry of Works, who also told Mr. Willey that the expenditure incurred was £268,535. The corresponding figures for 1954-55 were 311 and £295,550.

THE NATIONAL STEELWORKS at Volta Redonda, Brazil, broke all previous production records in 1954, after the new battery of 21 coke ovens came into operation. The output of coke increased by 124,751 to 456,789 tons; pig-iron by 168,231 to 538,490 tons; and steel ingots by 105,817 to 588,193 tons.

WORK FOR 200 more people will be found at Tullos factory, Aberdeen, by the end of this year, as the result of a change in production now taking place there. The factory, which is owned by the Consolidated Pneumatic Tool Company, Fraserburgh, is switching from aero-engine work to the production of pneumatic tools.

CONSTRUCTION of a giant drum and armature shafts, which finished, machined, and coupled together weigh over 17 tons and are 37 ft. 2 in. in overall length, has been completed by the Fife Forging Company, Limited, Kirkcaldy. The equipment is destined for abroad and will form the basis of pithead winding gear.

A PORTABLE HYDRAULIC TOOL intended for straightening damaged conveyor flight-bars without removing them from the conveyor, has been introduced by A. G. Wild & Company, Limited, Sheffield. Weighing 43 lb. in working order, the tool incorporates a hydraulic ram manually actuated and capable of exerting a 5-ton pressure.

Mr. JOHN BLACK, a director of Metal Industries, Limited, presented the apprentices' prizes on February 19 to youths at Sentinel (Shrewsbury), Limited, one of the company's subsidiaries. The apprentice of the year was Geoffrey H. Kane who received the George Woodvine Memorial Cup and also the prize for the best fourth-year apprentice.

EXPORTS CREDITS GUARANTEE DEPARTMENT has opened a new branch in Newcastle-upon-Tyne, to serve the areas of Tyneside, Wearside and Tees-side. Pending completion of the new offices, the manager of the new branch, Mr. J. A. Bookless, will be operating from temporary premises at 93A, Grey Street, Newcastle-upon-Tyne, 1. (Telephone: Newcastle 26011.)

THE FOREIGN LABOUR DIVISION of the Ministry of Labour and National Service is moving from Regents Park to Ebury Bridge House, Ebury Bridge Road, London, S.W.1, next Monday. Any communications or enquiries regarding the issue of permits under the Aliens Order, 1953, to bring foreigners to this country for employment should be made to the new address.

A MIDLANDS BRANCH of the Society of Industrial Radiology was founded on February 26 at a meeting at the Birmingham Engineering Centre. The branch is the third to be established in the country. It is estimated that there is a potential membership of some 350 between Rugby and Matlock. The Society is the only one exclusively concerned with industrial radiology.

MR. BEVINS, Parliamentary Secretary to the Ministry of Works, told Mr. Willey that the Committee on Individual Efficiency in Industry had so far sponsored 12 research projects. The work was progressing satisfactorily, and interim reports on some of the projects would be presented during a conference arranged by the Medical Research Council, to be held at Cambridge at the end of this month.

IN 1954 the Brazilian Cia. Vale do Rio Doce began mining the ore deposit on Conceicao Peak, large-scale mechanized mining having hitherto been restricted to the Caue Peak. The latter has a reserve of 100,000,000 tons of 68-69 per cent. hematite, with a total thickness of workable ore of about 150 metres. As annual production is of the order of 2,000,000 tons, the theoretical life of the deposit is 50 years.

ON FEBRUARY 24 Mr. J. Law, who until his recent retirement, was chief inspector for Smoke Abatement in Sheffield, said that in one part of Sheffield the sulphur content of the air is five times as high as anywhere else in England. He was speaking at a meeting of the Incorporated Plant Engineers at the Grand Hotel, Sheffield, on "The problems of smoke abatement." He also said that it was uneconomical to use limestone in buildings in Sheffield because the sulphur in the air will eat it away in 25 years.

News in Brief

FELTHAM MARINE ENGINES, widely used to power light craft, are to be manufactured on Tees-side by a subsidiary of the Middlesbrough engineering concern, E. & L. B. Pinkney (Borough Bridge), Limited, in conjunction with its associate company, Imeson & Finch, Limited, Stockton. This follows negotiations with Bruce & Holroyd, Limited, Feltham (Middx), manufacturers of the engines for almost 30 years.

THE KEEL has been laid down at the Wallsend yard of Swan, Hunter, & Wigham Richardson, Limited, of a 31,000-ton d.w. ore carrier for the M. A. Hanna Company, Cleveland, Ohio, which is due to be completed next year. The vessel will be the sister ship of one now building by the Furness Shipbuilding Company, Limited, at Haverton Hill. Both will be used to carry ore from Labrador to United States Atlantic ports.

COMMENCING IN MARCH a series of film shows is being held at the Birmingham Exchange and Engineering Centre in conjunction with the Central Office of Information. The films will be shown to an invited audience of engineering apprentice supervisors and are designed to demonstrate the potential educational value of the technical film. An invitation is extended to any exhibitor at the Centre who would like to send a representative to these performances.

DERBY SOCIETY OF ENGINEERS held their annual dinner at the Grandstand Hotel, Derby, Mr. A. Rimmer presiding, on February 18. Among those present were Mr. Berridge, president of the East Midlands branch of the Institute of British Foundrymen, Mr. C. E. Lee-Jones, chairman of the Derby Electrical Society, Mr. N. Drake (president, Nottingham Society of Engineers), and Mr. W. M. Coulson (president, Leicester Association of Engineers).

S. RUSSELL & SONS, LIMITED, held a display, at Bath Lane Works, of their production of s.-g. iron castings recently and in conjunction with this they had the first public showing of the Mond Nickel Company's film "S.-g. Iron—Cast Iron That Bends." Parts of this film were used in the TV programme "Science Survey" in October last. This exhibition and film show was attended by 120 representatives from local engineering firms, and their interest in this material was greatly stimulated.

BIRLEC LIMITED announce the following new addresses for area offices:—*London*, "Ediswan House," 155/161, Charing Cross Road, London, W.C.1 (Telephone: GERrard 8660), and *Newcastle-upon-Tyne*, c/o The British Thomson-Houston Company, Limited, 9, Higham Place, Newcastle-upon-Tyne, 1, (Telephone: Newcastle 25040). Mr. S. G. King is the manager of the London area and Mr. J. W. Payne, resident sales and service engineer in Newcastle-upon-Tyne.

A MEANS of mitigating a major disadvantage, which adds to steelmaking costs, was outlined at Glasgow on February 18 to the West of Scotland Iron & Steel Institute by Mr. A. M. Hamilton, of Colvilles, Limited, He described the Colville-Hamilton ladle metal-depth indicator, which can register accurately the level of molten metal in a ladle at any predetermined point and cut down waste due to underfilling of ingot moulds. In a second paper Mr. Hamilton described a practical method whereby an increase in yield is obtainable from killed-steel ingots by a slight modification in the design of hot-tops.

AT THE English Steel Corporation, Limited, Sheffield, 2,500 workers and their guests saw two showings of the firm's new 55-minute colour film "Engineers in Steel" at the City Hall on February 17. Mr. F. Pickworth, the managing director, was unable personally to introduce the film, so his speech was filmed and then shown on the screen. In addition to the main film, another one, "Britain's Heaviest Steel Casting," was shown. Two further showings took place on February 22, enabling a large number of the Corporation's 10,000 employees to see the films. "Engineers in Steel" has been produced in five language versions for world-wide showing.

ALL EMPLOYEES of Leyland Motors, Limited, are to share in the improved trading results of the company by receipt of an additional bonus. Last month it was announced that trading results were £3,135,383, with a net profit of £1,056,311 (last year £771,297), and that the share capital was to be adjusted by the issue of two fully paid shares for one existing stock unit so as to bring the share capital more into line with the capital employed in the business. The company has also set aside £250,000 to cover past services in the free pension scheme which was introduced at the beginning of this year for all hourly-paid employees.

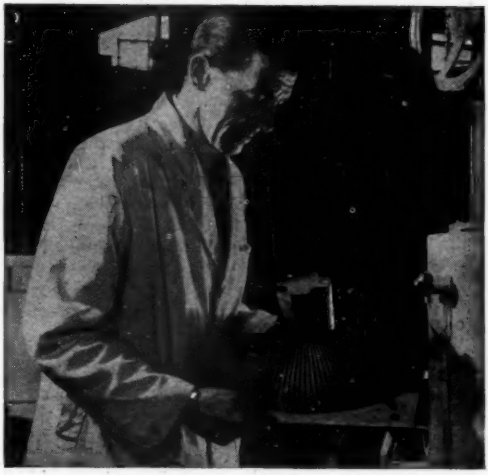
EPOXY RESINS are now being produced for making plastic patterns. Aero Research, Limited, Duxford, Cambridge, who are responsible for the development of "Araldite" casting resin M for patternmaking, state that shrinkage on setting is very low indeed and quite negligible when fillers are used. It is also claimed that the hardened resin is tough, durable and dimensionally stable. "Araldite" casting resin M sets cold in 24 hrs., or in a shorter time if gentle heat is applied. As shrinkage and brittleness have hitherto been regarded as inherent defects of plastic patterns, the introduction of the epoxies into this field will arouse considerable interest in foundries. Full details of "Araldite" casting resin M are obtainable from the makers.

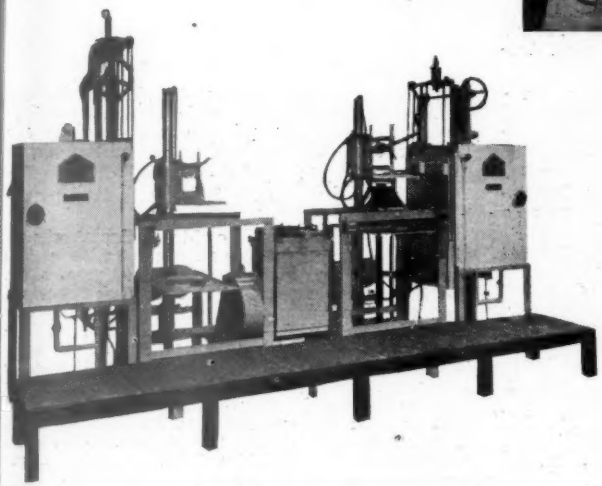
NORTHERN IRELAND foundry executives complain that increasingly short supplies of scrap for some time past have been restricting their operations, with a consequent decline in local employment. In the local Parliament Mr. M. Morgan has stated that although a local firm had been informed that an English company desired to send steamers to Belfast for breaking-up purposes no encouragement has been offered by the Government or the Belfast Harbour Board for berthage facilities requisite for their accommodation. He had inspected the harbour area and noted that several areas were suitable for the erection of shed and other requisites necessary for implementing the proposal. Undaunted by the red tape objections and apathy, Mr. Morgan will again raise the question in Parliament.

MR. FRANK HENDERSON, an Oxfordshire farmer, speaking at the National Power Farming conference at Harrogate, recently, gave a hint to manufacturers of farming equipment to pay more attention to the instruction books they supplied with farming machinery. Tractor books were excellent, but, with a few notable exceptions, the instructional information provided with the rest of the machines was really shocking, and it was not always sent with the machine. It was often the case that machines had to be put together by the farmer or perhaps the agent, who knew no more about them. He knew of two cases where assembly sheets had arrived a week after the machines had started work. In one case the instructions could not be followed because of the terms used, and in the other the machine had been modified after the sheet had been prepared, which made the instructions just nonsense.

Shell Moulding in 3D

The Shelmolda 'Altus' will handle patterns up to 13in. in height or depth and therefore will provide a greater variety of sand/resin moulds than any other machine on the British market. All the main operations are carried out mechanically and the minimum of physical effort is required from the operator.





The Shelmolda "Altus" (patent applied for)

Capacity

Effective pattern plate sizes of 16in. by 16in. and 16in. by 12in. Handles pattern plates 13in. high or 13in. deep in each oven. Will produce from split pattern 26in. overall. Oven opening adjustable up to 16in. above or below centre line.

Operation

Semi-automatic, with everything at all times under operator's full control. Oven doors, dump box and receptor pneumatically operated. Adjustable ejector mechanism. Investment time electronically controlled. Gas or electric ovens.

May we send you further particulars?

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AP 236-72

Personal

COUNCILLOR GEORGE BLOUNT, 56-year-old works shunter at Stanton Ironworks, has been named as the new Mayor of Ilkeston, Derbyshire.

Mr. A. G. TOWNLEY, Australian Minister for Air and Civil Aviation, visited the works of Rolls-Royce, Limited, at Derby, on February 25.

Mr. E. WEBSTER, who joined Peglers, Limited, brass-founders, Doncaster, 30 years ago, has been appointed service and general sales manager of the company.

Sir HUGH CHANCE has been re-appointed chairman of the West Midlands Advisory Council for Technical Commercial and Art Education for a three year period.

MONSANTO CHEMICALS, LIMITED, announce the appointment of Dr. H. R. NEWMAN, medical officer at the Newport factory, as principal medical officer of the company.

Mr. E. H. C. LEATHER, M.P., has been retained by Leyland Motors, Limited, in a consultative capacity on economic affairs, particularly connected with export activities.

Dr. T. B. CROW, until recently technical director of Emery Brothers, Limited, has joined the research and development department of Foundry Services, Limited, Nechells, Birmingham, 7.

Mr. CHARLES PULLAN, sales director, of Armstrong Whitworth (Metal Industries), Limited, Gateshead, and Jarrow Metal Industries, Limited, sailed on February 24 for a business tour of South Africa.

Mr. S. B. DEW A.I.M. (lately a director of Wellworthy, Limited), has recently been appointed general manager of H. J. Maybrey & Company, Limited, aluminium founders, of Worsley Bridge Road, London, S.E.26.

NEWTON CHAMBERS & COMPANY, LIMITED, has appointed its secretary, Mr. R. J. V. WHEELER, to be a local director. He joined the company in 1952 as deputy secretary, taking over the secretaryship the next year.

Dr. H. G. TAYLOR, director of research of the British Welding Research Association since 1947, has been elected president of the Society of Engineers. He has been associated with the Society since 1947 and has been a member of its council for seven years.

IN A YEAR'S TIME Sir John S. Boyd will retire as permanent vice-president of the Shipbuilding Employers' Federation, and with a view to a successor to the position the Federation has appointed Mr. NORMAN A. SLOAN, Q.C., its director designate. He took up the appointment on March 2.

Dr. W. H. J. VERNON, O.B.E., who recently retired from his post as head of the corrosion section of the Chemical Research Laboratory of the Department of Scientific and Industrial Research, is to receive the Whitney award, presented annually by the National [American] Association of Corrosion Engineers for distinguished contributions to corrosion science.

GENERAL ELECTRIC COMPANY, LIMITED, announces that Mr. R. N. MILLAR, lately chief mechanical engineer to the British General Electric Company (Pty.), Limited, Australia, has been appointed to take charge of its newly-formed Industrial Atomic Energy Section. The new organization is located at the company's Erith works which is under the direction of Mr. ARNOLD LINDLEY.

OWING TO PRESSURE of his diverse activities, GENERAL NORGUET, general manager of the Ateliers et Chantiers de la Loire has had to relinguish the vice-presidency of *Centre Technique des Industries de la Fonderie*—a position he has held since 1950. A Government decree of January 20 nominated Mr. A. E. LE THOMAS—the director of the *Centre*—to the position rendered vacant.

Mr. STANLEY CLARK has been appointed chief executive of the Society of Motor Manufacturers and Traders. The appointment follows a reorganization of the Society. Mr. R. GRESHAM COOKE has left his position as director of the Society as a result of his election as Member of Parliament for Twickenham. Mr. Clark, who is 50, first joined the organization in 1946 as secretary. As chief executive he will continue to have control of the organization of the motor, commercial motor and other exhibitions at Earls Court.

Sir JOHN GREEN has resigned as a member of the Iron and Steel Holding and Realization Agency, but has agreed to be available to the agency in an advisory capacity. Sir John joined the agency in 1953. Before that he was chairman of the Iron and Steel Corporation of Great Britain, having succeeded Mr. Steven Hardie to the chairmanship in 1952. He is also a director of Mitchell Engineering, Limited, Peterborough, and the East Midlands Gas Board. In January it was announced that Sir John had joined the Sheepbridge Company, Limited.

Obituary

THE DEATH is announced of Mr. SYDNEY A. PIPER, the Midlands representative of the Constructional Engineering Company, Limited. He was the victim of a street accident, being knocked down whilst crossing the road. He was very well known and highly esteemed in foundry circles. He was a cousin of Mr. D. H. Wood, the chairman of the company.

THE DEATH is announced of Mr. R. ECCLES who was the branch manager in Glasgow of the British Insulated Callender's Cables, Limited. He was 57 years of age. Mr. Eccles was educated at Queen's Park School and the Royal Technical College, Glasgow. He served his apprenticeship with P. & W. MacLellan, Limited (Engineers), of Glasgow to whom he returned after his service in the Royal Flying Corps during the 1914-18 war. He joined the former British Insulated Cables, Limited, in 1928 and served in their contracts department until 1942 when he was transferred to the sales department at their Edinburgh branch. On the formation of British Insulated Callender's Cables, Limited, in 1945 he was appointed transmission engineer for Scotland and held this position until 1953 when he became branch manager of their Glasgow office.

Mr. DAVID A. BREMNER, director of the British Engineers' Association from 1919 to 1943, died on February 7, at the age of 88. During his tenure of office he was a member of the Grand Council of the Federation of British Industries and served on no fewer than 34 FBI committees. In 1928 he was elected to the Standardization and Simplification Committee of the Board of Trade and the following year to the Mechanical Industry Committee of the British Engineering Standards Association, continuing his work when the latter body became the British Standards Institution, Mr. Bremner received the OBE for services during the first world war as head of the aluminium section of the Ministry of Munitions. Before joining the BEA, he was one of the managing directors of Chance & Hunt, Limited, Oldbury.

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Raw Material Markets

Iron and Steel

The existence of reserve stocks of pig-iron, which at the beginning of this year slightly exceeded 8,000,000 tons, qualifies the fear that supplies are running short; but it is beyond doubt that current production falls short of the demand, and it has become imperative that additional blast furnaces should be started up as soon as possible. Apart from the swollen needs of the steelworks, foundrymen are specifying larger tonnages and find that these are only obtainable with great difficulty—if at all. The not infrequent lack of low-phosphorus iron can be overcome by the use of hematite, but makers of this grade are working under heavy pressure and cannot further increase their deliveries.

Some of the steelmakers are confronted with a dilemma over the supply of billets. Production has increased, but it is not surprising that works give first consideration to the needs of their own finishing mills. This no doubt accounts for the discrepancy between high outputs and limited deliveries to the independent re-rollers. To bridge the gap, foreign billets and slabs have been bought, but so far imported tonnages have been limited and consumers are still clamouring for better deliveries of home semis. Any parcels of defectives which come on to the market command a ready sale and re-rolling scrap is also in brisk demand.

All the sheet and heavy rolling mills are working under extreme pressure. Consumers are eager to buy in spite of warnings that they will have months to wait before there can be any hope of delivery. In fact, the gap between supply and demand seems to be widening and British buyers are now reported to be operating in the American market.

Record tonnages of American sheet are likely to be imported and there is a considerable unsatisfied demand for joists and sections. The plate situation is a little easier.

Non-ferrous Metals

Details of production and usage of copper, published by the Copper Institute in New York, for January show that in the United States output of crude copper was 96,100 short tons, a drop of 1,600 on the December tonnage, while that of refined copper, at 123,800 tons, was some 9,700 tons below the December level. Deliveries also fell: the total of 114,000 tons in January compared with 119,700 tons in December, but these figures do not, of course, include deliveries to the stockpile. Stocks of refined copper in producers' hands at January 31 were 45,982 tons, against 47,108 tons at the end of December.

Outside the States a similar trend was observed, but the decline in output was much greater as a result of the Copperbelt strike. The drop in production of crude copper amounted to some 19,000 tons, the total for the month being 111,200 tons. In refined copper the setback was even more pronounced, for the December figure of 109,100 tons was reduced to 85,600 tons in January; an improvement in February can hardly be expected. Stocks of refined copper in producers' hands were 159,300 tons at January 31. The only bright spot in the figures outside the US was the fact that deliveries of refined copper to consumers, at 112,900 tons, showed an increase of 3,400 tons over December.

Business on the market last week was fairly brisk and the turnovers were rather above average. In the early part of the week copper looked to be heading for a major decline for a short time, but a recovery set in with considerable activity in the three months position, which went ahead rapidly to close at £330, some £5 10s. better than a week earlier and only £12 below the cash quotation. Indeed, the rise in cash was only £1 to £342. A backwardation of £12 is something not seen for a long time. Opinion seems to be divided on the prospects for copper, but there seems little chance of a fall at present.

The price of prompt zinc fell by £2 last week, but three months lost only 15s. and the backwardation was reduced to 10s. Lead was steady with a drop of a bare 5s. in both positions, while tin gained £1 for cash and 30s. for three months. This week has seen the adoption of a new order for dealing on the Exchange, copper now coming first and opening at 12 noon, followed by tin, lead, and zinc.

Official metal prices were as follow:—

COPPER, Standard—*Cash:* February 24, £339 to £339 10s.; February 25, £340 to £340 10s.; February 28, £334 to £336; March 1, £341 10s. to £342 10s.; March 2, £344 10s. to £345.

Three Months: February 24, £327 to £327 10s.; February 25, £329 to £329 10s.; February 28, £324 to £324 10s.; March 1, £331 to £332; March 2, £332 10s. to £333.

TIN, Standard—*Cash:* February 24, £707 10s. to £708; February 25, £712 10s. to £713; February 28, £705 to £706; March 1, £712 10s. to £713; March 2, £712 to £713.

Three Months: February 24, £712 to £713; February 25, £717 to £717 10s.; February 28, £710 to £712; March 1, £717 to £717 10s.; March 2, £717 10s. to £718.

LEAD—*Second half February:* February 24, £103 to £103 5s.; February 25, £102 10s. to £102 15s.; February 28, £101 15s. to £102. *First half March:* March 1, £102 15s. to £103 5s.; March 2, £103 5s. to £103 10s.

Second half May: February 24, £102 5s. to £102 10s.; February 25, £102 to £102 5s.; February 28, £101 10s. to £102. *First half June:* March 1, £102 5s. to £102 10s.; March 2, £102 10s. to £102 15s.

ZINC—*Second half February:* February 24, £88 to £88 10s.; February 25, £86 15s. to £87 5s.; February 28, £85 5s. to £85 10s. *First half March:* March 1, £86 10s. to £86 15s.; March 2, £87 to £87 5s.

Second half May: February 24, £86 15s. to £87; February 25, £86 to £86 5s.; February 28, £85 15s. to £86. *First half June:* March 1, £86 5s. to £86 10s.; March 2, £86 15s. to £87 5s.

London Branch "Stag Party"

Members of the Institute of British Foundrymen who wish to attend the London branch "Stag Party" at the Horse Shoe Hotel, Tottenham Court Road, on March 18 are reminded that March 4 is the date before which priority in ticket allocation is granted them. After that date members' and guests' applications for tickets will be dealt with strictly according to the date received. The accommodation is limited and those who would like to join the party and yet have not applied for places are advised to write without delay to the assistant branch secretary, Mr. A. R. Parkes (c/o FOUNDRY TRADE JOURNAL, John Adam House, Adelphi, London, W.C.2.).

INVENTORS in Britain and the Commonwealth have been invited to take part in a competition which is being run by the British Industries Fair. Twenty ideas will be shown on one stand at the London section of the fair and the best will receive an award of £200. There will be second and third prizes of £50 and £25.

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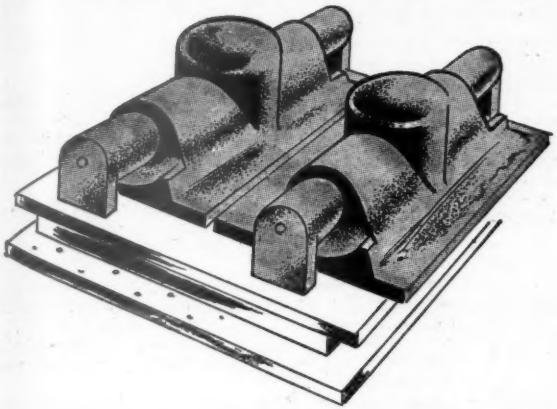

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Current Prices of Iron, Steel, and Non-ferrous Metals

(Delivered unless otherwise stated)

March 2, 1955

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2:—Middlesbrough, £15 12s. 0d.; Birmingham, £15 5s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £17 13s. 9d., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent. P, up to 3 per cent. Si), d/d within 60 miles of Stafford, £18 9s. 3d.

Scotch Iron.—No. 3 foundry, £18 2s. 3d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £20 4s. 0d.; South Zone, £20 6s. 6d.

Refined Malleable.—P, 0.10 per cent. max.—North Zone, £21 1s. 6d.; South Zone, £21 4s. 0d.

Hematite.—Si up to 2 per cent., S. & P. over 0.03 to 0.05 per cent.:—N.-E. of England (local iron), £18 2s. 6d.; Scotland (Scotch iron), £18 9s. 0d.; Sheffield, £19 7s. 6d.; Birmingham, £19 14s. 6d.; Wales (Welsh iron), £18 9s. 0d.

Basic Pig-iron.—£15 15s. 6d. all districts.

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered)

Ferro-silicon (6-ton lots).—40/55 per cent., £40 15s. 0d., basis 45 per cent. Si, scale 15s. per unit; 70/84 per cent., £63 0s. 0d., basis 75 per cent. Si, scale 16s. per unit.

Ferro-vanadium.—50/60 per cent., 23s. 8d. to 25s. 0d. per lb. of V.

Ferro-molybdenum.—65/75 per cent., carbon-free, 11s. 0d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, £161 0s. 0d. to £165 0s. 0d. per ton; 38/40 per cent., £258 0s. 0d. to £262 0s. 0d. per ton.

Ferro-tungsten.—80/85 per cent., 18s. 0d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 21s. 0d. per lb. of W.

Ferro-chrome (6-10 ton lots).—4/6 per cent. C. £78 0s. 0d. to £80 0s. 0d., basis 60 per cent. Cr, scale 25s. 0d. per unit; over 6 per cent. C, £76 0s. 0d. to £78 0s. 0d., basis 60 per cent. Cr, scale 24s. 0d. per unit; 2 per cent. C,* 1s. 8½d. per lb. Cr; 1 per cent. C,* 1s. 9d. per lb. Cr; 0.15 per cent. C,* 1s. 10½d. per lb. Cr; 0.10 per cent. C,* 1s. 10¾d. per lb. Cr; 0.06 per cent. C,* 1s. 11d. per lb. Cr.

Metallic Chromium.—98/99 per cent., 6s. 6½d. to 7s. 1d. per lb.

Metallic Manganese.—93/95 per cent., carbon-free, £225 0s. 0d. to £232 0s. 0d. per ton; 96/98 per cent., £255 0s. 0d. to £262 0s. 0d. per ton.

Ferro-columbium.—60/75 per cent., Nb + Ta, 52s. 6d. to 70s. 0d. per lb., Nb + Ta.

Ferro-manganese (home).—78 per cent., £54 15s. 0d.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft, u.t., £25 5s. 0d.; tested, 0.08 to 0.25 per cent. C, £26 5s. 0d.; hard (0.41 to 0.60 per cent. C), £27 10s. 0d.; silico-manganese, £34 10s. 0d.; free-cutting, £29 6s. 6d. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £32 17s. 0d.; silico-manganese, £34 10s. 0d.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £29 13s. 6d.; basic, hard, over 0.41 up to 0.60 per cent., C, £30 16s. 0d.; acid, up to 0.25 per cent. C, £33 15s. 0d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £31 1s. 6d.; boiler plates (N.-E. Coast), £33 11s. 6d.; floor plates (N.-E. Coast), £32 10s. 6d.; sectional material, N.-E. Coast, £29 4s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., untested, £31 19s. 6d.; flats, 5 in. wide and under, £31 19s. 6d.; hoop and strip, £33 1s. 6d.; uncoated strip mill coils, hot rolled, under 3mm. to 12g., £34 5s. 0d.; black sheets (hand mill), 17/20 g., £43 13s. 6d.; galvanized corrugated sheets, 24 g., £54 17s. 0d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £54 7s. 9d.; nickel-chrome, £76 7s. 9d.; nickel-chrome-molybdenum, £86 8s. 6d.

NON-FERROUS METALS

Copper.—Cash, £344 10s. 0d. to £345 0s. 0d.; three months, £332 10s. 0d. to £333 0s. 0d.; settlement, £345 0s. 0d.

Copper Tubes, etc.—Solid-drawn tubes, 3s. 2¾d. per lb.; rods 375s. 6d. per cwt. basis; 20 s.w.g., 406s. 9d per cwt.

Tin.—Cash, £712 0s. 0d. to £713 0s. 0d.; three months, £717 10s. 0d. to £718 0s. 0d.; settlement, £713 0s. 0d.

Lead (Refined Pig).—First half March, £103 5s. 0d. to £103 10s. 0d.; first half June, £102 10s. 0d. to £102 15s. 0d.

Zinc.—First half March, £87 0s. 0d. to £87 5s. 0d., first half June, £86 15s. 0d. to £87 5s. 0d.

Zinc Sheets, etc.—Sheets, 15 g. and thicker, all English destinations, £115 15s. 0d.; rolled zinc (boiler plates), all English destinations, £113 10s. 0d.; zinc oxide (Red Seal), d/d buyers' premises, £103 0s. 0d.

Brass Tubes, etc.—Solid-drawn tubes, 2s. 6¾d. per lb.; rods, drawn, 3s. 3¾d.; sheets to 10 w.g., 328s. 3d. per cwt.; wire, 3s. 1¾d.; rolled metal, 314s. 6d. per cwt.

Brass (Brazing).—BS1400, B3 (65/35), £215; B6 (85/15), £302; BS249, £252.

Brass (High Tensile).—BS1400, HTB1 (30 tons), £264; HTB2 (38 tons), £276; HTB3 (48 tons), £287.

Gunmetal.—RCH, 3/4 per cent. tin, —; BS1400, LG2 (85/5/5/5), £285; LG3 (86/7/5/2), £294; G1 (88/10/2/½), £379; (88/10/2/1), £364.

Phosphor Bronze.—BS1400, PB1 (AID released), £391 per ton.

Phosphor Bronze Strip, etc.—Strip, 460s. 3d. per cwt.; sheets to 10 w.g., 482s. 9d. per cwt.; wire, 4s. 8d. per lb.; rods, 4s. 1½d.; tubes, 3s. 11½d.; chill cast bars: solids 4s. 1d., cored 4s. 2d. (CHARLES CLIFFORD, LIMITED.)

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide × 0.056. 3s. 11d. per lb.; round wire, 10g. in coils (10 per cent.), 4s. 4½d.; special quality turning rod, 10 per cent., ½ in. dia., in straight lengths, 4s. 3½d. All prices are net.

Other Metals.—Magnesium, ingots, 2s. 3d per lb. Antimony, English, 99 per cent., £210 0s. 0d. Quicksilver, ex-warehouse, £109 0s. 0d. to £110 0s. 0d. Nickel, £519 0s. 0d. Aluminium, ingots, £163 0s. 0d.; aluminium bronze (BS1400), AB1, £340; AB2, £350. Solder, brazing, BS1845, 2s. 6d. lb.; granulated, 2s. 9d. lb.

* Average 68-70 per cent.